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48120

April 1994

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- **Build a Balloon Fuel Tank— *Inexpensive and Efficient!***
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APRIL 1994 VOLUME 122, NUMBER 4

MODEL AIRPLANE NEWS

FEATURES

***ABOVE**: at the Scale Masters, Shailesh Patel's Yellow Aircraft F-14A Tomcat comes in one wing low (see article). Photo by Rich Uravitch.*

***ON THE COVER**: staff photographer Walter Sidas took this photo of the Lanier Laser 200 (see review) against the Connecticut sky. Jim Onorato, editorial contributor, piloted the craft.*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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EDITORIAL

TOM ATWOOD

GIANT SCALE RACING ON THE INCREASE

How big will giant-scale racing become? Its rapid expansion in the last three years may be only a modest prelude. Remember, you don't have to be directly involved in giant-scale racing to appreciate it; this is one heck of a spectator sport as well!

Two all-new 1994 races, inspired by the annual Madera Unlimited races and operating under the Giant Scale Air Racing Association (GSARA) rules, have been announced in recent months. One is the Sky Racers Grand Prix to be held in Sanair, Montreal, Canada, from August 15 to 21, 1994. For more details, see page 8 of our March '94 issue, or call (514) 449-0142. The other new race is the '94 Texas Unlimited Air Races and Air Show, scheduled for May 10 to 15, in Galveston, TX (see below). Incidentally, for more information on the '94 Madera race, which is scheduled for late September, call (310) 320-8369, and for information on the R/C National Championship Air Races to be held in Reno, NV, from June 2 to 5, call (702) 677-0869.

Aerial shot of a portion of the Galveston, TX, municipal airport, which will host the '94 Texas Unlimited Air Races and Air Show.

I asked Rob Wood, our correspondent on the unlimited racing circuit, to provide some background on the Galveston race and how it fits into the larger picture. His brief report follows:

"Giant-scale racing is growing at such an accelerated pace that keeping track of it is becoming a full-time job; 1994 promises to be the biggest year yet, with at least three major races slated for summer and fall. The first of these races is scheduled for May 10 to 15 at the Galveston, TX, municipal airport. The Galveston Economic Development Council, the city council and the airport management have rolled out the red carpet for the event. These organizations have clearly seen the potential of the sport for adding yet another attraction to their already thriving resort town.

"Galveston is a beautiful island on the Gulf Coast, about 30 minutes south of Houston on I-45. The airport is a four-block walk from the white-sand beaches of the Gulf; a two-block walk from Moody Gardens, one of the finest family attractions in Texas; and a one-block walk from The Lone Star Flight Museum, one of the nation's premier flying museums. The museum will be providing flybys and static displays of some of the most beautifully restored WW II aircraft I've seen, including six of the seven flying P-38 Lightnings left in the world and a fully operational B17.

"As with any fine beach town, accommodations are plentiful, the people are friendly, and seafood restaurants are everywhere. Hi-G Promotions, the sponsoring organization, has promised to treat the racers "royally." There will be an excellent purse, top-qualifier money and contingency prizes from major giant-scale manufacturers. As of December 27, Hi-G—the sponsoring organization for the Galveston race—reported 56 AT-6 and 30 unlimited entries for the May races.

"The rules for the Galveston races will follow GSARA guidelines. During a GSARA "summit conference" held in Phoenix, AZ, on December 11, promoters of most of the major '94 races agreed to create a seat on the board for a representative of the Texas group (Mike Wise), to have open elections for three pilot seats and to cooperate fully in promoting the sport.

"Two new racing events will be introduced in Galveston. The first of these, 42-percent scale Formula One racing, will have slightly different rules from those of the '94 Madera version. Although Madera will require a minimum airfoil thickness of 13 percent, Galveston will allow thicknesses of 10 percent or more. In addition, Galveston will allow engines of 6ci displacement, while Madera plans to limit engine sizes to 4.6ci. As of this writing, all other Formula One rules will be the same for the two races.

THOMPSON TROPHY RACING

"The second new event to be unveiled at Galveston will be Giant Scale Thompson Trophy racing. The models for this event must be patterned after full-scale aircraft that qualified for the Thompson Trophy races (1929 to 1939), and they must conform to minimum specifications as supplied by the Houston group. To get this event off the ground, the promoters are offering free registration for the 1994 races. As for the other classes, Unlimited registration fees are set at $300, Formula One at $225 and AT-6 Texans at $175.

"The Thompson Trophy and Formula One races are experimental events: the GSARA membership will be asked to vote to accept the classes and to approve a set of rules for each after the end of the '94 season. It is hoped by everyone concerned that the new spirit of cooperation will continue to spread and that all racing events in the Western Hemisphere will soon be held under the same rules.

"For information about the May races in Galveston, contact Hi-G Promotions Inc., P.O. Box 219181, Houston, TX 77218-9181; (713) 391-4799; fax (713) 391-4799 (dial 99 after answer)." ■

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ERRATA

Our February cover shot, taken by Dan Parsons, was mis-captioned. That photo, as it appeared on the cover and on page 75 in Rob Wood's article on the '93 Madera Unlimited Races, should have stated: Robert Reisner's Aerrow 200RS-powered Stiletto (customized from a DW airframe) is caught on a practice lap (the plane did not compete). The plane featured Robart retracts, Tru-Turn spinner and JR receiver and servos.

John Lockwood's Saxton Mustang, to which the cover and article captions in fact referred, is shown below. Lockwood took first place in Bronze.

MICHAEL VAN STAAGEN, WHERE ARE YOU?

I'm writing to you about Michael Van Staagen's Micro Jet 2, featured in the May '92 issue of *Model Airplane News*. He was a second-place winner in your second R/C design contest. The design interests me, and I'd like to know where to get a set of plans. I've been involved in aeromodeling for about six years. I'm looking for a small model, so if you could send me some information on where to send for plans, I would really appreciate it. And please keep up the good work.

CORY ACKER
Waldo, OH

Cory, we'd like to publish the Micro Jet 2, but unfortunately, we've lost contact with Michael Van Staagen. We have been unable to reach him at his old address and phone number for some time. If any readers know him, please pass this message on: Michael, could you please give me a call at (203) 834-2900, fax (203) 762-9803, or send e-mail to me on the Internet at toma@airage.com. We'd like to resume the conversation and publish your design. There are a lot of readers who are really interested in building it! Thanks. TA

ON TAMING THAT STALL

Roy Day's "Taming that Stall" article published in the November '93 *Model Airplane News* did a laudable job of describing ways to prevent, and sometimes cause, stall-related control problems with model aircraft.

Stalling ultralight, short-chord, low-speed, sub-miniature model aircraft (that have such low Reynolds numbers that their "lift factor" is "asymptotic with zero") is an art in itself! But Roy's message that adding stall strips to prevent this behavior is a very dangerous proposition. Roy's mention that some (most notably Mooney) private aircraft employ this to preserve control authority should have been underscored by the comment that when added to some popular model airfoils, stall strips will cause serious loss-of-control problems. The *only* application of this method that I have seen work successfully has been in the Italian-made Scorpio kits, where the obechi-covered wing design prevents effective washout technique.

Finally, Roy's use of my comment (Rob Wood's quote at the top of Roy's article) regarding washout, and further inference reference to stalls as the cause of our racing aircraft losses at Madera '92 appears to be out of context. Our pilots are not happy with this presentation. As pilot/builders, their four firsts and three seconds in giant-scale unlimited racing belies any inference that they would ever build "stall-prone" miniature aircraft.

DAVID C. ABBE, AMA 5962
El Cajon, CA

IN REPLY

Dave Abbe's comments on my article "Taming that Stall" in the November '93 issue contains several statements that require comment.

All airplanes, full scale and miniature, can be stalled if there is sufficient elevator-control authority. What is preferred is a straight-ahead, gradual stall, not an abrupt tip-stall with the attendant roll. All stall alleviation techniques have the same objective: to cause the inboard wing to stall before the outboard, resulting in a wings-level descent with full aileron control. Stall strips are one way to accomplish this by effectively sharpening the leading edge of the inboard wing; this causes it to stall earlier than the outboard. (Airfoils with small leading-edge radiuses stall at lower angles of attack.)

Dave's statement that "when added to some popular model airfoils, stall strips will cause serious loss-of-control problems" is just not supported by the facts. I have flown several models of different design with inboard stall strips with no control problems. Even at the low Reynolds numbers of models, there is no technical basis for their [model stall strip] effectiveness to be greatly different from that of full-scale aircraft where they are used. Besides the Mooney (mentioned by Dave), Piper Tomahawk, Navion and Bonanza as well as a number of home-built airplanes have been equipped with stall strips.

I am not pushing stall strips as the best stall-alleviation device, but I question Dave's making the statement that stall strips "will cause serious loss-of-control problems" without any supporting data or technical basis.

I am sorry that Dave and the pilots of the crashed Madera racers were offended by my reprint of a part of the article by Rob Wood from the February '93 issue of *Model Airplane News*. It was included to highlight the fact that even the best pilots are sometimes bitten by the stall characteristics of their airplanes. This in no way detracts from their success at the Madera races.

ROY DAY, AMA 2182
Aerospace engineer, model designer
Rockville, MD

(Continued on page 137)

COLE PALEN

1925 • 1993

FORTY YEARS ago, a modest young man who loved very old airplanes acquired a small handful of them from the old Roosevelt Field Museum. Back then, few people were interested in these tired old birds.

With a little money and a lot of hard work, in two years, Cole Palen had a genuine 1909 Bleriot and a Spad fighter from WW I flying again. Working largely alone, he managed to restore the rest of the planes during the next decade. In the early '60s, he bought a small abandoned farm near Rhinebeck, NY. Cole and a few friends, such as Dick King and Dave Fox, roughed out an airstrip and began flying informal old-time air shows on weekends for fun.

Gradually, small crowds came to watch the action. Although a hat was passed around, no admission was ever charged. These early flying shows were unforgettable, and they had a friendly, non-commercial charm.

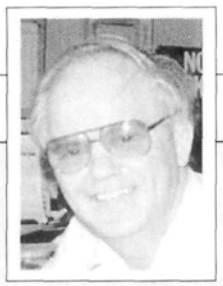
During the next three decades, the show grew into a world-famous, old-time aviation extravaganza. It was the only place where you could see WW I and pre-WW I airplanes flying every weekend. Most of these aircraft were actually powered by their original ancient engines. It has been noted that Cole and Dick King probably spent more time flying behind rotary engines than any WW I pilot ever did.

Cole Palen was a very fortunate man. He worked very hard and thoroughly enjoyed what he was doing. He was totally dedicated to his chosen profession, and Providence smiled on him. No one was ever seriously injured while flying those tired old airplanes, and Cole died peacefully in his sleep.

The aviation world has lost a truly unique personality, and modelers have lost a good friend. For almost 30 years, Cole welcomed them to his Aerodrome for their annual R/C Jamboree. His memory will live on in the new Rhinebeck Aerodrome Museum Foundation.

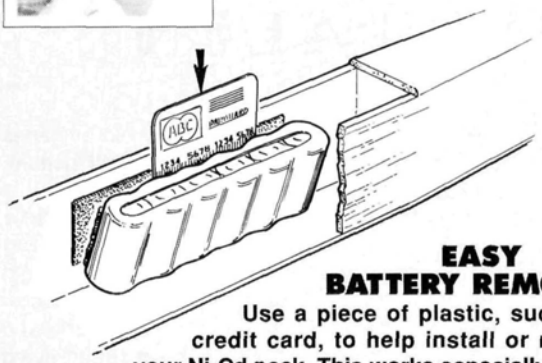
Frank Gudaitis

HINTS & KINKS



JIM NEWMAN

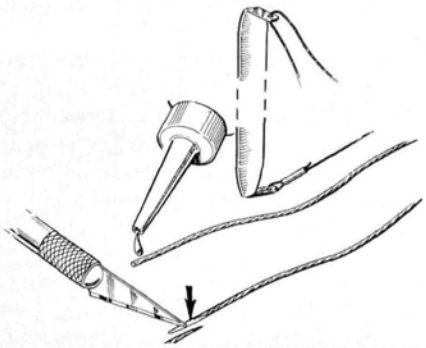
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



EASY BATTERY REMOVAL

Use a piece of plastic, such as a credit card, to help install or remove your Ni-Cd pack. This works especially well in narrow fuselages. The card pries apart the pieces of Velcro®-brand fastener; then it acts as a shield to prevent them from sticking together until you want them to.

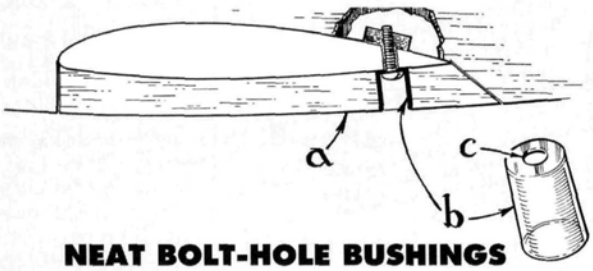
Don Ryan, Ft. Pierce, FL



EASY CORD THREADING

If you have to thread cord through very small holes to simulate rigging, you can harden and sharpen the end of the cord to make the task easier. Apply thin CA to about 1 inch of the cord's free end. Quickly pull the cord through your pinched finger and thumb to remove the excess glue; when the CA has cured, slice the cord at an acute angle to make the "needle." It really works!

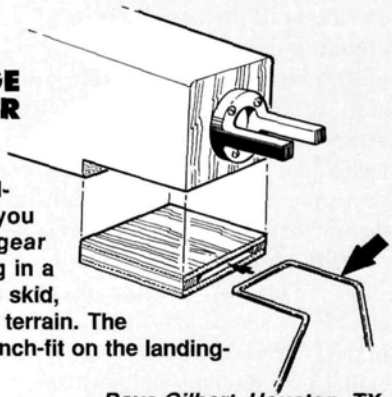
Tom Akin, Pacifica, CA



NEAT BOLT-HOLE BUSHINGS

Where a wing bolt has to go through a deep belly fairing (a) or an intake duct (as it does on a P-51), use the plastic cap (b) from a CA bottle to make a bolt-hole bushing. Roughen the outside of the cap, and drill a clearance hole in it (c) for the wing bolt. Then glue the cap into the block and sand it to match the fairing profile. (PFM glue works extremely well on polyethylene plastic.)

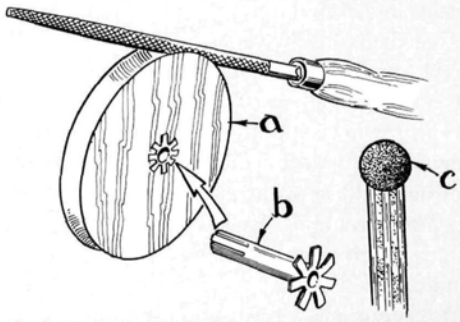
George Kasabian, Los Angeles, CA



QUICK-CHANGE LANDING GEAR

This ply and spruce box on this AMA-class climb-and-glide model allows you to change landing gear quickly. You can plug in a single skid, a double skid, or wheels to suit the terrain. The slot must be a firm pinch-fit on the landing-gear wire.

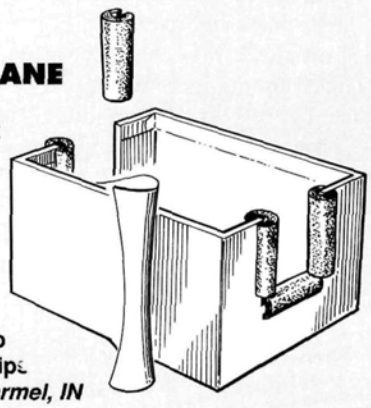
Dave Gilbert, Houston, TX



BUDGET SPORT-SCALE WHEELS

This 6-inch wheel (a) was cut out of construction-grade 3/8-inch-thick plywood. It has a bushing made of a slit brass tube (b) whose end was slit in several places and then fanned out and glued into the center of the disk. File (or use a Dremel ball in a drill press) a rounded groove around the edge of the wheel, then glue on an industrial-size, solid-rubber O-ring (c). (You can get these O-rings from an outlet that specializes in large valves and pipe fittings.) Your wheels will cost hardly anything.

Jim Carter, Minot AFB, ND



FRUGAL AIRPLANE CRADLE

This cardboard box has been covered with vinyl shelf paper and padded with inexpensive, foam, pipe insulation. You can give the inside a coat of urethane varnish to protect it from fuel drips.

Charles Koby, Carmel, IN

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

TOP FLITE TEXAN

I've been hearing great things about Top Flite's most recent line of scale kits. Specifically, their computer-designed, interlocking parts fit amazingly well, making construction a pleasant experience. I'm sure the new, all-balsa AT-6 kit is no exception. This .60- to 1.20-size, 1/7-scale Texan has a 69-inch span and 713 square inches of wing area. Special scale touches include a highly detailed "greenhouse" canopy plus many accurate decals. It weighs 7.5 to 10 pounds.

NEXT PULL-OUT PLAN

It seems our pull-out plans have been very well-received by readers. So, we've enlisted the help of design wizard Rich Uravitch to come up with the next one, and here it is: a .25-size, 38-inch-wingspan A-7. Like the rest of King Uravitch's designs, the Corsair flies fantastically. I wasn't the only one impressed with this little attack model. Dry-Set will be producing a two-sheet set of markings for the Corsair, and what you see here is just a small sample of what actually comes on those two sheets. For those of you who haven't tried Dry-Set's pressure-sensitive transfer markings, they're extremely simple to apply, and they're fuelproof without adding a clear coating. They look as if they've been painted on. Dry-Set offers hundreds of sheets for all sorts of scale projects, and they'll also do custom work for a small fee. Contact: Dry-Set, 7029 Sanger Ave., Waco, TX 76710. (817) 741-0379.

IN-COWL TEAM

In the short time it has been available, the 2-stroke Webra 1.20 has become a favorite of scale modelers, owing to its light weight, smooth handling and good power. Unfortunately, the muffler choices for this engine have been few. Now Slimline offers this aluminum, low-noise, bolt-on, Pitts-style muffler in smoker and non-smoker versions. Designed for side-mounted applications, this combination will fit nicely within the cowl of countless scale subjects. For more information on their line of American-made mufflers, contact Slimline, P.O. Box 3295, Scottsdale, AZ 85257; (602) 967-5053.

TITANIC DRIVE

According to Hobby Lobby International, their new titanium gearbox will generate 2 pounds of thrust with the Graupner Speed 500 motor, a 12x5 prop and 7 cells and 24 ounces with a Speed 600, a 12x5 prop and 8 cells. Not bad for such inexpensive motors. Nineteen ounces of thrust and 9.25 minutes of duration are possible with a Speed 600, a 10x4 prop and 8-cells. This 1.72:1 ratio drive has steel ball bearings and gears while the remainder of the structure is titanium. This slender unit uses a spur gear with inside-diameter teeth that take advantage of motors with non-adjustable timing. The unit is 1⅞ inches long and weighs a mere 1 ounce! For small-electric-model lovers, the titanium gearbox is now also available for the diminutive Graupner Speed 400. For more info, contact Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.

PRESSURE?...CHECK!

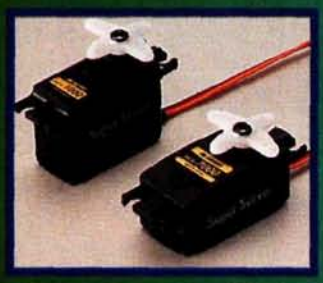
Think of the time, money and disappointment you'd be spared if you knew in advance the retract system was leaking and pressure was low. We've all seen the damage gear failure can cause during landings and high-speed takeoff runs. This little, 1½-inch-long, externally mounted pressure gauge from Robart Mfg. is tremendous insurance for that beloved scale model. The externally mounted gauge T-mounts into the fill line of your air system and reads up to 150psi, in 20psi increments, as the system is filled. Retail is $14.95, a small price to pay considering the damage that can result from that dreaded one-wheel landing. For more info, contact Robart Mfg., 625 N. 12th St., P.O. Box 1247, St. Charles, IL 60174; (708) 584-7616.

THE DAVIS SOLUTION

While large gas engines have made a successful transition from other industries into the model airplane industry, the mufflers and motor mounts they've brought with them haven't fared so well. Davis Model Products' Big Foot Motor Mount, Flex S.S. Header and Soundmaster Big Engine Muffler, shown here with a Zenoah G-62 and Lanier Stinger, rise to the occasion when it comes to keeping large engines firmly mounted and quiet. The Big Foot Mount, which is machined from 6061 bar-stock aluminum, is 4½ inches in diameter, 1⅝ inches deep and allows access to the spring starter for lubrication purposes. The foot-long, stainless-steel Flex S.S. header screws directly into the exhaust mount, and it all hooks up to the Soundmaster Big Engine Muffler.

Using a Sachs 3.7, IMAA V.P., Duke Hoeckele produced a pleasant 88dB measured at 3 meters. Thank you, Bob Davis! Oh yes, the entire system, including the muffler, is shock-mounted. Contact Davis Model Products, P.O. Box 141, Milford, CT 06460; (203) 877-1670.

SUPER SERVO!



At the recent World Modeling Championships in Austria, secret new JR servos—the NES 4000 and NES 7000—were used by four top competitors. Using these new "Super Servos," Hanno Prettner and Chip Hyde in F3A Pattern, and Curtis Youngblood (pictured) and Kazuyuki Sensui in F3C Helicopter swept first and second places in both classes, respectively. At the Chicago show, we got a close look at these new gems. While technical details are still sketchy, according to Horizon Hobby Distributors, JR has integrated some patented new circuitry that gives the new servos five to ten times the "holding torque" (the ability to hold a certain position under load) of currently available servos. How much new circuitry? The prototype NES 4000 servo has four new circuit boards that have been added to the previous base board! We've been promised further details of the Super Servos as soon as they become available. Stay tuned....

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

And the winners are...

Each year, we are faced with the difficult task of picking the best of our "Pilots' Projects" entries (still our most popular column). Every month, our mailbag is filled with photos of the most interesting and beautiful model airplanes from the U.S. and around the world. It is with great pleasure that we present this year's talented winners.

1ST PLACE—$500.
■ ALEC CORNISH-TRESTRAIL of Gloucestershire, England.
■ Scratch-built deHavilland FAW2 Sea Vixen ducted-fan jet (September 1993 issue).

Built in ⅛ scale, the model spans 75 inches, is 84 inches long and has a wing area of 1,460 square inches. The 26-pound model is powered by two O.S. .77 engines that turn Dynamax fans and are coupled to JMP tuned pipes. This impressive model can be taken apart into six pieces for easy transportation, and it's said to climb well on one engine.

2ND PLACE—a one-year subscription to *Model Airplane News* and a set of Air Age Publishing model aviation books.
■ FRED WOLF of Pittsburgh, PA
■ Scratch-built, aluminum-clad AT-6 Texan (August 1993 issue).

Fred built this beautiful model from Ziroli plans. He covered the entire airframe with numerous litho-plate aluminum panels and added 12,262 miniature rivets for the ultimate in scale Texan appearance. The canopy's frames are also made of strips of the litho-plate material, and the interior is completely

detailed—down to the smallest knob and switch. The detailed, non-retractable landing gear was scratch-built, and the engine cowl is made of spun aluminum. The model weighs 35 pounds, has a 101-inch wingspan and is powered by a trusty Zenoah G-62.

3RD PLACE—a one-year subscription to *Model Airplane News* and a set of Air Age Publishing model aviation books.
■ RAY AGEN of Anchorage, AK.
■ deHavilland Beaver bushplane (December 1993 issue).

Built from a Unionville kit and outfitted with Unionville floats, this deHavilland Beaver bushplane is powered by an O.S. .91 4-stroke engine turning a 13x6, three-blade prop. The model has working flaps, landing lights, a retractable water rudder, a scale dummy engine and a completely detailed and upholstered interior.

GYRACING THE SKY

This Gyrace twin autogyro is the work of Peter Johnson of Walton Hills, OH, who has been modeling since 1939. Peter, who is originally from the U.K., says that during WW II, to everyone's delight, an uncle in the U.S. would send him *Model Airplanes News*. The autogyro was designed by Englishman David Boddington who is the editor of the U.K. publication *Radio Control Scale Aircraft*. The autogyro's rotors are 25 inches in diameter, and the O.S. .25 engine allows the model to loop and roll, and in a slight headwind, hover. Peter says that, at the top of a loop, the rotors stop for a split second before the model roars down the back side of the maneuver. After flying this great model, Peter put aside all his other models.

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1994. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

PILOT PROJECTS

¼-SCALE EASY

This ¼-scale Rutan Long Easy canard pusher is the handiwork of Eugene Eberle of El Cajon, CA. Eugene blew up a ⅛-scale set of kit plans and then built the Long Easy using the same techniques used in the full-size version, which is a foam and fiberglass composite. The model took eight months of part-time work to complete; it has an 80-inch wingspan, it weighs 13 pounds, and it's powered by an ASP .91 engine.

EXTRA PERFECT

John Wagner of Kentwood, MI, built this great-looking Extra 300 from a Zinpro Marketing kit, and he powers it with a mighty SuperTigre 3000 engine. A Futaba radio guides the plane, and John's eight-year-old daughter Shawna is the co-pilot.

EXTRA-LARGE XCELERATOR

Held aloft by Alicia McClaviahan, this Lairdair Aviation XL+3 Xcelerator is the work of Tom Bookwalter of Manhattan, KS. With a wingspan of 88 inches and an O.S. BGX-1 engine for power, the huge sport plane weighs 16.25 pounds. The model is covered with MonoKote and it's equipped with a Slimline Smoker muffler. The paint on the cowl, wheel pants and landing gear is Pactra Formula-U. Tom has two more XL+3s under construction.

YOUNG R/C EAGLE

Fifteen-year-old Aaron Butler of White Plains, NY, is pictured here flying his Hirobo Shuttle ZX heli, which is powered by an O.S. .32 engine. Aaron has been involved in R/C for two-thirds of his life; he started with R/C cars and boats. He has been flying R/C for four years now—one year with his heli. Look out, Chip Hyde: a new generation of R/C eagles is on its way!

SUPER SUKHOI

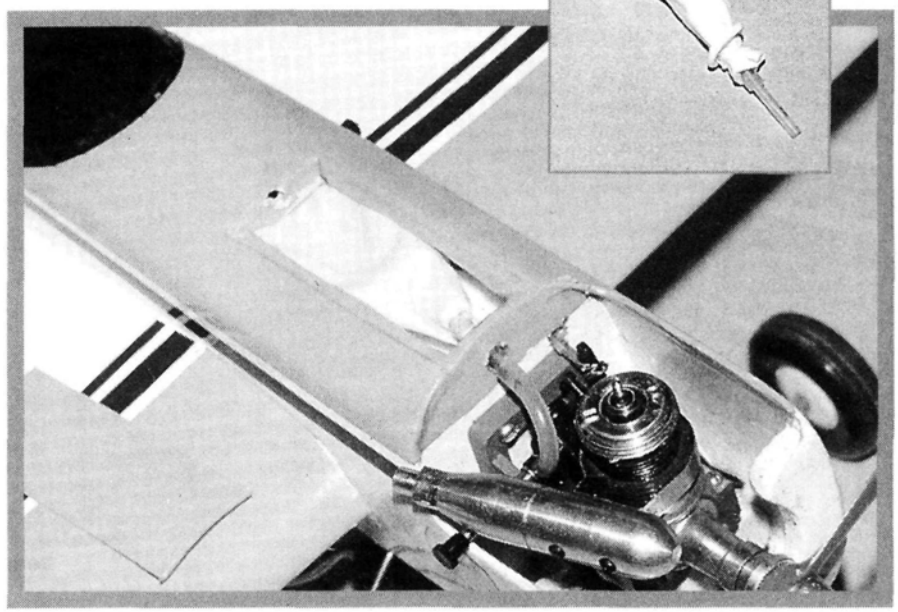
This Ohio R/C Su26Mx is the work of Don Fisher of Big Lake, MN, and it's powered by a Zenoah G-62 with a Dan Reichmuth ignition system. The model has a wingspan of 84 inches; it's finished with ½-ounce fiberglass cloth and painted with Hobbypoxy blue and white, and the pink is catalyzed urethane. Don uses a Slimline Pitts-style smoke muffler to keep the Zenoah's roar down and to paint vapor trails in the sky. He uses a JR X-347 radio. Don's daughter (and constant flying buddy) Jill gives scale to the big sky dancer.

CYCLONE DESIGNER

Fourteen-year-old Mike Hague of Bristol, IN, shows off the Cyclone America pattern plane that he designed and built himself. The model has a symmetrical airfoil, a balsa-sheeted foam wing, and a 63-inch wingspan. The 53-inch-long fuselage is made of balsa and light plywood. The horizontal stab has anhedral. Powered by a Fox .50 engine, the model weighs 6 pounds, 4 ounces. Mike has been flying regularly for the last five years, and he says he gets to the flying field at least once a month—even in the winter time. ■

HOW TO Build A Balloon Tank

by NICK ZIROLI SR.



The balloon tank is not only good for small areas, but it will also conform to oddly shaped areas. This collapsible "fuel cell" gives much more reliable needle settings. Inset: the finished balloon tank even comes in your favorite color!

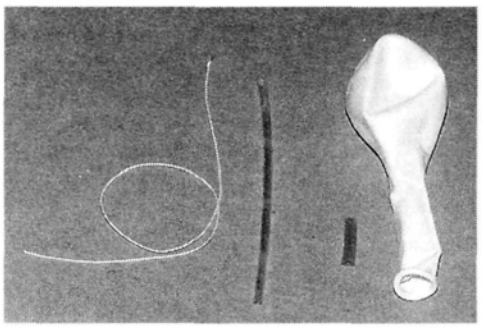
PHOTOS BY NICK ZIROLI SR.

More reliable runs with 1/2A engines

MY BRIEF description of a balloon fuel tank, which I used in the Mini Sukhoi SU-26 that I wrote about in the January '94 issue, piqued the interest of editor Tom Atwood. He suggested that a more detailed follow-up might be of interest to other modelers.

This isn't a pressure tank, and I can't take any credit for inventing it. My first experience with this type of fuel tank was more than 40 years ago. I remember how well it worked then, and it still works well today.

The fuel tank was in one of Jim Walker's products. If you're an old-timer in this hobby, you know who Jim Walker was—model aviation's greatest inventor and manufacturer. If you don't, I must tell you that much of the hobby that you enjoy today can be credited to this man's genius. A list of his achievements would fill this page and more. Harold deBolt, you should do an in-depth feature on this great man. I'm sure you knew him.



Here are the approximate amounts you'll need of each material. The small length of silicone fuel tubing serves as a seal between the Ace EZ tubing and the balloon's neck.

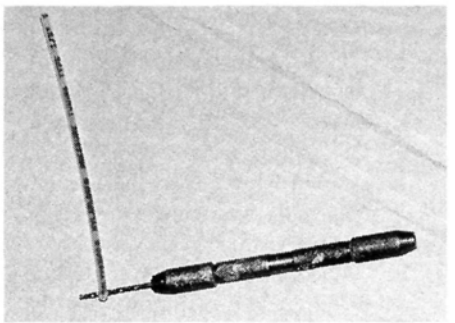
You'll need a 9-inch balloon, Ace R/C EZ fuel tubing, a length of small silicone fuel line and 6 inches of heavy-duty thread.

The Jim Walker "Firebaby" that was manufactured in the early '50s came with a fuel tank just like the one that's described here. The Firebaby was a ½A, control-line, ARF model. All that was required was to attach the wing and mount an engine. We used the OK Cub .049; it was inexpensive and ran pretty well.

We have used a similar, though much more sophisticated, fuel-tank system in remotely piloted vehicles. The fuel tanks, which held about 5 gallons each, were in the wings and didn't have any fill caps or vents. They were made of a soft plastic material and were filled with an anti-slosh foam that took up only 1 percent of the tanks' volume. We totally collapsed each tank using a vacuum pump, and them we filled them with fuel. As the fuel was consumed, the tanks collapsed again. This made efficient use of the limited space in the wing.

The fuel tank that's shown here is very easy to make, and it's simple to install in many small models. I used a 9-inch balloon that had about a 1½-ounce capacity, and for the pick-up line, I used a piece of Ace* plastic EZ fuel tubing. (You could also use 3/32- or ⅛-inch-diameter brass tube, but I

prefer the plastic.) Sand the end of the tubing that will be inside the balloon tank so that it's round and smooth. Drill a 1/16-inch-diameter or smaller hole across the tubing, close to the end. Sand off any burrs so they won't damage the balloon. Slide a 1-inch piece of small fuel line over the plastic tubing, and position it so that it will contact the balloon's neck when the balloon is tied onto



You'll need to drill a small hole at the pick-up end of the Ace EZ tubing for efficient tank drainage and to prevent the balloon from closing off the end hole in the pick-up tubing.

the tubing. This will make a good seal between the balloon and the tubing. Insert the tubing so that it is near the other side of the balloon. Fold the neck of the balloon back over itself, secure it to the tubing with five or six wraps of string, and tie it securely. Cut the tubing to suit the installation. That's it.

Use a squeeze bulb to fill the balloon tank. Fill the bulb about half full of fuel. Before you connect the bulb to the tank, squeeze the bulb down a little to take some air out. After you've connected it, release the bulb to remove all the air from the tank. To fill the balloon, hold the bulb filler-end-down and the plane nose-down. Overfill the tank slightly, and remove the bulb. A little fuel will come out of the tank, but there shouldn't be any air in it.

Whichever technique you use to fill the tank, it's important that the tank contain as little air as possible. Connect the fuel line to the needle valve, and fire the engine up. I think you'll find that this simple tank will give you constant needle-valve setting and good, reliable engine runs from beginning to end.

**Here's the address of the company that's mentioned in this article:*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.* ■

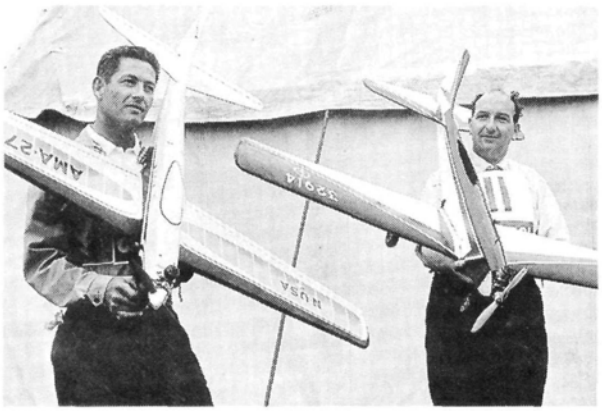
GOLDEN AGE OF R/C

HAL DeBOLT

'62 WORLD CHAMPS

THIS MONTH, I'm indebted to Bill Winter and Ace R/C's "Grid Leaks" newsletter for my story about the most closely fought FAI R/C World Champs to date—the second one. It was 1962, and as reigning champions, the English team were the hosts at RAF Kenley in Surrey, just outside London.

"Pattern" and plane designs were in their infancy, and we were still learning how to do the maneuvers. (Kazmirski said a maneuver "glitch" was really only a "beauty mark"!)



Co-winners of the second World Championships: (left) Tom Brett with his K&B-powered, Orbit-equipped Perigee. Harry Brook's entry was powered by a McCoy .60 and guided by F&M—both reed systems.

GENTLEMEN, SWITCH ON YOUR RADIOS!

Thirty-two countries sent pilots to Kenley; even the Russians were there for the first time. Unfortunately, with their homemade equipment and antique-style aircraft, they were out of their league, but everyone gave them an "A+" for effort.

At the first Champs, each pilot had been allowed only two flights—a distinct handicap, as my first-flight radio failure and Dunham's engine problems on both flights showed. (Others also had troubles.) At the second Champs, three flights were allowed; each pilot flew once a day over three days. As you'll hear, that change in the rules dramatically affected the outcome of the '62 Champs.

The first day's weather was typically British—cold, with a 25 to 30mph wind; even so, the meet began as scheduled. The odds-on favorites were the reigning champs—the English team: Harry Brooks, Frank Van den Bergh and Chris Olsen—and the American team: Tom Brett, Don Brown and Willis Robinson. Robinson was a late substitute for Doug Spreng, who was unable to make the trip, and he hadn't had much time to prepare. He had to use a new model after practicing for only about half an hour with it. Under such circumstances, his ninth place was outstanding.

The models were obviously influenced by the Orion—the design Kazmirski dominated the *first* Champs with. The major contenders—except for Don Brown, who used his time-proven Dee Bee shoulder-wing—flew low-wing designs of one sort or another. With his Multiplex proportional radio, Don was said to fly "smoother" than anyone. Brett's Perigee was of the Orion caste, but it had its own distinct features, e.g., the wing trailing edge was sharply swept forward while the stab leading edge was swept rearward. This effectively lengthened the tail-moment arm without adding to the fuselage. In contrast, Englishmen Brooks and Van den Bergh's planes were 2 pounds heavier than Brett's and had wingspans that were nearly 1 foot greater. Brett used a K&B .45 and Orbit reeds; the Brits used a McCoy .60 and F&M reeds.

With his modern-looking entry, Harry Brooks was the English championship team's top scorer (note "Taurus" resemblance).

The meet was dominated by American radios; Orbit "black boxes" were all over the place. Outstanding was Brown's propo system, which everyone thought pointed the way to the future. (How true we now know that was!)

Van den Bergh was thought to be England's "top gun." On the first day, he got off to a great start, but after recovering from a tailspin that was to have been his third from last, his model dove straight in. That left him with an all-night rebuilding project, and Dunham discovered that his problem had been caused by a faulty switch. Still, he had a decent score. (At the Zurich Champs, my radio failed a third of the way through my first flight. Nevertheless, my score up until then and an excellent second flight were enough to put me in sixth place.)

After Van den Bergh, Brooks put up a fine flight to score high, but the day wasn't over. Brown's outstanding flight earned the top score. Brett and Olsen trailed the pack, seemingly bothered by the weather.

Fortunately, the second and third days saw vastly better conditions. Day two was a bit warmer and less windy—more to the Americans' liking. Again, Van den Bergh had troubles with the spin: he stalled on recovery, and that ended his second flight short. Brown looked as if he was set for another fine score, but with three maneuvers left, he ran out of fuel. (Darn, if it isn't the little details that hurt the most when the chips are down!) Brett's performance improved considerably and would obviously have to be reckoned with. With the others, Robinson had completed both flights without incident or fanfare, and Olsen was stalking the leaders. Day two ended with

A TRIBUTE TO TOM BRETT

It's sad to have to write about the loss of a good friend, Tom Brett (the second of our world champions to leave us much too soon).

The Tom I knew was a quiet, sincere, ex-Navy pilot and avid modeler/engineer with sparkling eyes.

A native of Indiana, Tom worked at the Detroit GM Technical Center where he engineered trunk lids (so if one accidentally closed on your cherished model, you could always jokingly blame Tom!). Tom and his wife, Helen, lived in Sterling Heights, and Tom became an outstanding member of the R/C Club of Detroit.

At a Toledo show, Helen Brett presents the world champion Perigee to AMA president John Grigg (on right) and AMA director John Worth. The plane is now in the AMA museum.

His engineer's mind was apparent when he designed his workshop. It's difficult to build a true structure on anything but a perfect base, so the major feature of Tom's immaculate shop was the long bench, which he assembled and trued in bowling-alley style! Unlike most of us, he assembled wings vertically from the leading edge up, aligning them by using his bench as a reference point!

On the U.S. FAI team at the '61 Nats, Tom flew his Nimbus, but he wasn't nationally recognized. Once on a team, perfectionist Tom set about preparing for the Champs; he designed and built totally new models according to the very latest aviation findings. Remember, at that time, pattern designs were in their infancy, and Tom thought that Dunham's Voltswagon was the acme, so he related to that.

When Tom's Perigee became the number-one world model, I thought the design would be a worthy addition to Dmeco's Live Wire series, so we did our best to kit and publicize it. For some reason we never understood, the effort was a disaster; hardly anyone wanted what seemed to be a fine world champ design. Considering the effort that we put into the project, this was a real heartache for us both.

I recently learned that, after returning from the '62 World Champs in England, Tom put the Perigee and the Apogee into storage, and he never competed seriously again. Perigee, in all its glory, now resides in the AMA museum.

All of modeling has lost a true compatriot and a great champion, while his wife has lost a lifelong, irreplaceable companion. We deeply mourn his loss.

England's Brooks in the lead, but the real excitement was yet to come!

TOP *THIS* FOR TENSION!

The last day began with fine weather; the best two flights would determine the champion. Brooks had the lead, but there were three possible contenders—Olsen, Brown and Brett—and Van den Bergh was a possibility, but a long shot. Olsen needed a 1,700-point flight, Brown needed 1,627, and Brett needed 1,535.

This time, Van den Bergh put in a good, complete flight, but he was short on points. Olsen, with the best flight to that point (1,507 points), didn't find a way to top that by 200. Brown got off well and did a nearly perfect tail slide (the toughest maneuver in the pattern), but his fate was sealed when his engine quit on exiting the slide.

Brett—a "cool customer"—was left as America's only hope, and he flew his last flight just as well as he had flown during practice. His attitude was: it's now or never. He got almost exactly what he needed; tabulation put him 1.9 points ahead of Brooks. But wait a minute! FAI rules say the winning score must be 2 percent greater than the others! So his jubilation was short-lived! For the only time to date, there were *two* world co-champions!

Don Brown with his Dee Bee, which was equipped with his own proportional Multiplex system. Engine problems plagued his otherwise excellent performance.

But it still wasn't over; because of the tie, there was the King of Belgians cup to contend for. A coin toss determined the flight order. An obviously nervous Brooks went first and was far off his best score with 1,288 points. The door was open for Brett, and he managed another consistently good flight of 1,496. He went home with the cup and the prestige of being the world's finest. The many months of preparation and practice had paid off; the U.S. was top dog again!

As the results indicate, England came close to taking it all, because Brooks' tie, Olsen's third and Van den Bergh's fourth gave them the team title. With Brett's first, Brown's fifth and Robinson's ninth, America was second.

Never since has there been such a closely contended World Champs—and there probably never *will* be! ■

MODEL AIRPLANE CONSTRUCTION NEWS MAGAZINE

Die Schwinge

by HAL DEBOLT

A highly efficient electric power enduro

HAVE YOU heard about the gu who was given a paperweigh that appeared—at most—to b gold plated? He kept it on his des until the day he discovered it wa solid gold! It's not hard to imagin his surprise and jubilation! M experience with the Schwinge ha been something like that. I designe built and test-flew it well over year ago, then I set it aside becaus it seemed to be little more tha another run-of-the-mill electri powered enduro.

Locals quickly dubbed this desig the "birdwing," and it certainly do seem appropriate when it's soaring high with the hawks. Schwinge is simp the German word for wing.

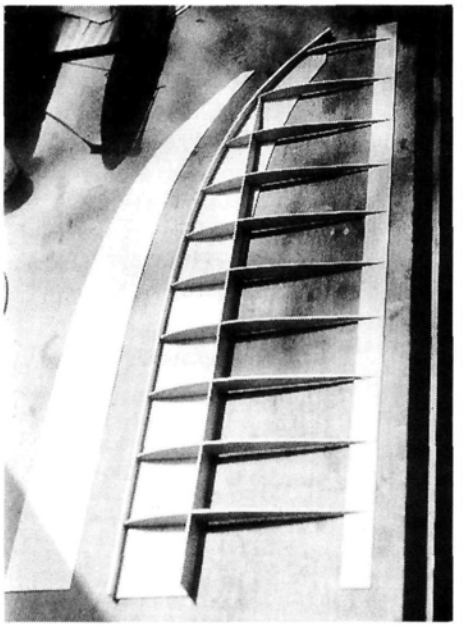
RETURN OF THE SCHWINGE

I was recently involved in evaluating some for arrangements, and the Schwinge seemed a logic vehicle for such tests. Imagine my surprise whe a modification really woke the design up so muc that it's now an outstanding performer!—so muc so that it would be a crime not to pass the conce onto others.

To whet your appetite: its powered climb is ste and fast; with the power combo used, it gets to ma ginal-sight altitude in about 30 seconds. You c expect three such climbs—plus some reserve—fro each battery charge.

Its glide mode is fast and flat with excellent pen tration, and it responds well to lift—just loves the mals. A greatly appreciated attribute is its wind weather performance; if anything, it seems to do be ter in wind than in calm. (At least, you don't have be "chicken" just because the wind is blowing!) It's design that has to be "flown"—definitely not pussycat, but it doesn't have nasty traits eith You'll find it exciting and fulfilling to fly!

PHOTOS BY HAL DEBOLT



Despite the wing's shape, the Schwinge's structure is simple.

DESIGN HISTORY

The concept arose from my desire to investigate three ideas that seemed to offer the possibility of improvement. Fortunately, all could be incorporated in one design.

SPECIFICATIONS

Type: electric-powered enduro
Wingspan: 60 in.
Length: 45 in.
Weight: 40 oz. ready to fly
Wing area: 550 sq. in.
Wing loading: 11 oz./sq. ft.
No. of channels req'd: 3 (rudder, elevator and motor on/off control)
Airfoil: Eppler 176
Wing: elliptical; all wood
Fuselage: wood
Washout built in?: no
Motor: AstroFlight 05 FAI geared
Prop: 12x8/10 folding prop

• **Uhu influence.** I had just finished evaluating the Hobby Lobby* Uhu, which had been raising eyebrows everywhere. It's a good electric enduro that, more than other electrics, requires a high flying speed to perform well. That seemed to be worth investigating. The Uhu is heavier than most types, and though it would be hard to do, some wondered whether reducing its weight would improve it. Another approach would be to incorporate the Uhu's higher flying speeds in a lighter design. Analysis revealed that the Uhu's speed is a result of its minimal profile drag. Its front profile area is about half that found in average electrics; so I reduced the Schwinge's profile (it's now very close to the Uhu's).

• **Need for downthrust.** It was apparent that I'd need downthrust to control the power that's now available. Downthrust has a negative impact on aerodynamics, so I wanted to limit it. With electric enduros, power control is difficult to dial in because of their wide speed envelopes. The Schwinge's power is controlled very effectively—aerodynamically—by ensuring that the lift produced by the wing and stabilizer are in the correct proportions.

• **Schuemann's wing planform.** At the Schwinge's inception, there was much talk and some data in the media about Schuemann's wing planform (swept wingtips). It seemed worth investigating. I've also long been aware of the value of elliptical planforms. Could both concepts be combined? To effectively combine them as much as possible, I laid out the prescribed Schuemann tapers, then connected the "high points" with a parabolic curve. From what I've seen, it does seem probable that a wing of this shape does improve performance. One thing is for sure: when it's thermalling on high with others, it's easy to pick this bird out of the flock; that wing is distinctive!

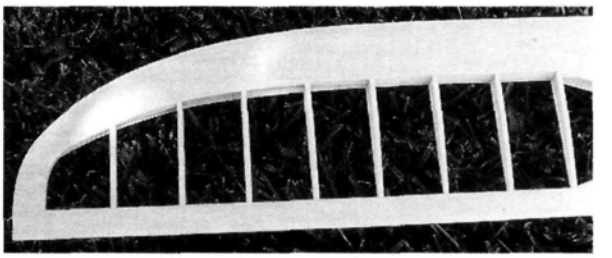
Beyond these "special effects," note the design's short nose and long tail-moment arm that creates maximum stability. To minimize drag, the fuselage cross-section is just large enough to enclose the equipment. Also note the "full flying" rudder that provides instant positive directional control at all speeds—something normal rudder setups often lack.

Obviously, the Schwinge will accept a variety of equipment, but what I describe here appears to offer the maximum possible performance. The sub-miniature, 5-ounce, Airtronics* airborne system used is about as compact as they get, and it's perfect for keeping down the weight. Better yet, it has operated flawlessly in several models and during thousands of flights.

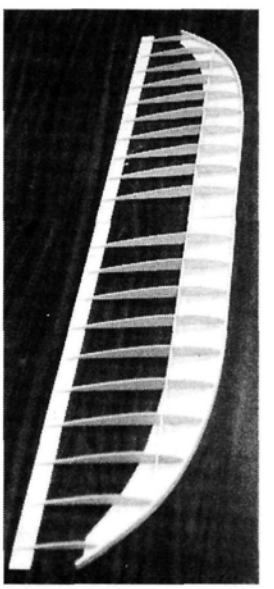
POWER REQUIREMENTS

With electric enduro, it's important to get sky high in the allotted time, and that means you need the correct power-to-weight ratio. The AstroFlight* 05 FAI geared motor is a fine choice. It drives a 12x8 propeller in the 5,000rpm range. The needed 30 amps are supplied by seven, 900mAh SCR cells. At least 14-gauge wire is required to transmit the current, and you should use connectors that have low resistance. The "on/off" switch is a simple 10A, 125V Radio Shack toggle switch. This entire power system weighs only 22 ounces.

The Schwinge has a final flying weight of 40 ounces; 28 ounces of that are radio and drive equipment, and that leaves only 12 ounces for the airframe—not much for a 5-foot model! Fortunately, this need for lightness is easily met with a judicious structural design. Strength with lightness is obtained by keeping the parts count low; if it isn't there, it can't add weight! The stressed-skin structure allows the use of medium-weight balsa; just don't use the rock-hard heavy stuff!



The completed wing structure is ready for covering.



Panels are joined before the top sheeting is installed.

CONSTRUCTION

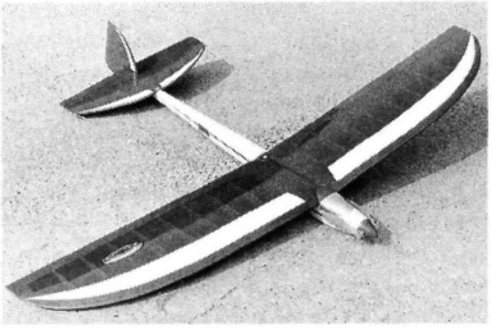
It's wise to build the wing and tail first, because you'll need them to complete the fuselage. So start with the wing; it's the most demanding part.

• **Wing.** Don't let the wing's lack of complexity or robust structure scare you. As shown by the few near terminal-velocity dives I made with the original, the wing is strong. It's built in halves from the bottom up, and the halves are joined before the top sheeting is installed. The wing's parabolic shape makes it necessary to make the leading-edge sheeting before starting assembly. This is done by making a pattern of the shape out of posterboard stock.

One sheet of 1/16x3x36-inch balsa is enough for one panel, but in the area of the outer span, an additional piece must be joined to it to complete the panel. Four shaped pieces are required—carefully matched

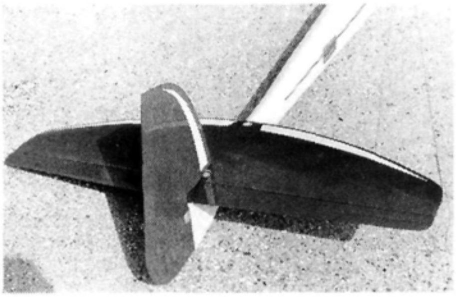
to the template.

Assuming you've made the ribs and the 1/16-inch-thick sheet spar, position the lower LE sheet for one wing panel on the plan. Using a few forward rib halves as gauges, position the spar on the sheet and cement it into place. Use CA for all joints. (Satellite City* Hot Stuff works well.)



Clean lines mean higher flight speeds. The white wing trim increases the Schwinge's visibility.

Next note that to make the forward bottom curve of the Eppler airfoil, you have to raise the front edge of the bottom sheeting off the workbench. The shim used to do this is just a narrow strip of balsa of an appropriate thickness. Next, cement the forward rib halves into place, except for the center rib. Position the lower trailing-edge sheet and install the aft rib halves. Because of the LE's pronounced curve, it's made by laminating one strip of 1/8x9/16 balsa onto another. While the glue is setting on the first panel, assemble the second one in a similar way, using the first as a guide for all the center joints.

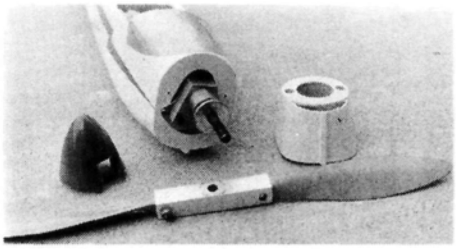


The simple full flying rudder gives quick, positive directional control at all flight speeds.

After that, fasten down one panel and align the second one with it. To establish the proper dihedral angle, use a piece of 2x4 (or something similar) as a jig. Also use a straightedge to ensure that the TE is straight. The LE, the spar and the TE of both panels are angled to fit together well at the center joint. Then join the two panels with CA. A scab piece of 1/16-inch plywood is used for the center spar joiner; believe me, nothing more is required. Now add the center rib.

Having done all this, add the top sheeting to the panel and fasten it down. Install the capstrips; use carpenter's glue (aliphatic resin) for this because it dries more slowly.

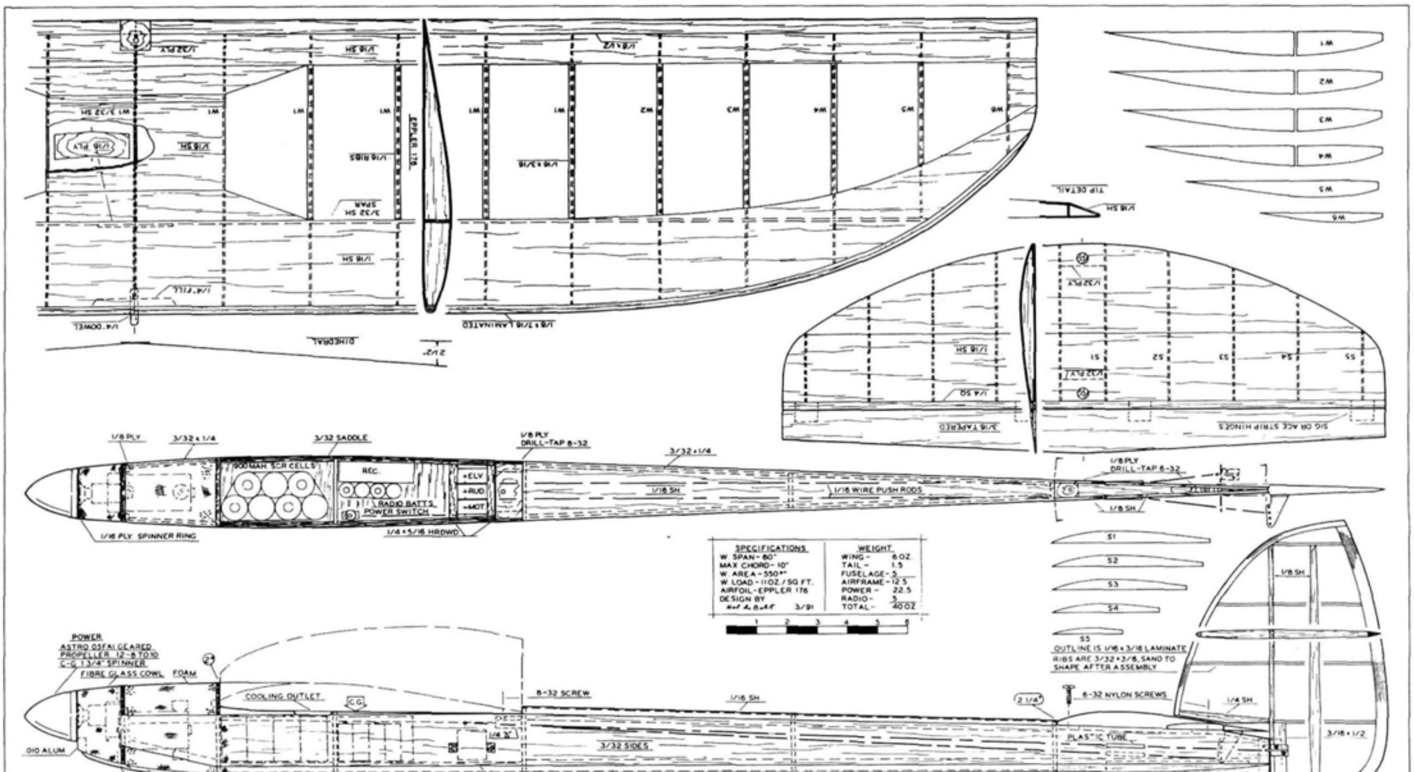
When the panel has dried, lift it off the bench and fasten down the opposite panel. After jigging it to set the dihedral angle, add the sheeting and the capstrips just as you did before. When it's convenient, glue the 1/8x1/2 trailing edges into place. Finally bevel the bottom of the wingtip with a sanding block, and add the 1/16-inch sheet tip plates.



The motor is installed from the front, using the simple aluminum mount, and it's covered by the cowl and its air-intake covers.

Having completed the structure, shape the LE and TE, and sand the entire wing. Do give it your careful attention: use a sanding block, and to prepare the surface for covering, go over it with 400-grit sandpaper.

• **Stabilizer.** First edge-glue enough sheeting to allow the shape on the plan to be cut out of it. Two sheets are required. Fasten one sheet



ORDER THE FULL-SIZE PLAN...FSP 04941...PAGE 117

to the bench and install the TE and ribs on it. Note that the top and bottom sheeting are joined at the LE. Add the 1/32-inch-thick plywood mounting plates, then follow with the top sheeting. The elevator is tapered out of 3/16-inch sheet and hinged to the stabilizer with strip hinges such as those from Sig* and Ace R/C*.

• **Rudder.** My first rudder had a "stick" structure. I was very unhappy with the way that the film warped it. There had to be something better! The excellent rudder shown on the Schwinge's plans was a positive answer.

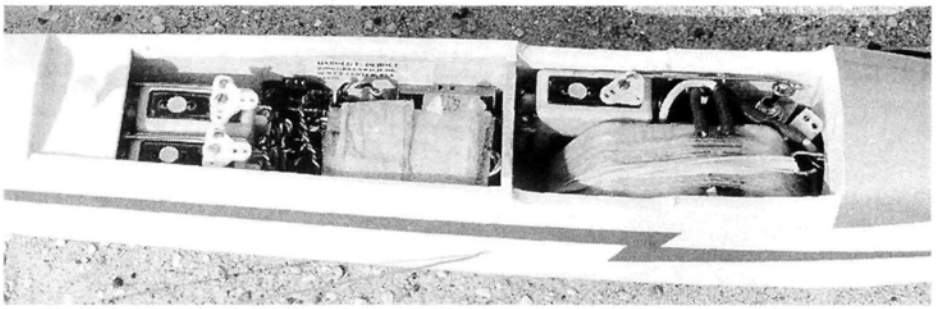
Start by cutting the outline shape of 1/8-inch-thick plywood (or something similar) to act as a form. Then soak 1/16x3/16-inch balsa strips in ammonia water and laminate them around the form, using aliphatic-type glue. This is amazingly easy to do. Then erect the tapered spar on the plan, and install the laminated outline around it. (To center it, the outline is shimmed 3/32 inch off the bench.) Install the 3/32x3/8-inch strip ribs and the other structures as called for. After assembly, the rib contour is shaped with a sanding block. Note that the rudder will be hinged with a 2 1/4-inch-wide strip hinge.

• **Fuselage.** This is also easy to construct. It's basically a box that's rounded with balsa sheeting on the aft top and bottom. If you wet the outside of the balsa with ammonia water just before you glue it into place, it will curve neatly.

The author strikes a launching pose.

Assemble the box on a workbench center line on which you've marked the positions of the bulkheads. The bulkhead center lines are aligned with the bench line as they're erected in place. They can be spot-glued to the bench with CA. With the bulkheads erected, install the already shaped sides around them. Before cutting the box loose from the bench, add all possible internal structures, including the aft top sheeting.

Note that, from the wing forward, the box is neatly faired into the spinner with Styrofoam. (This is done with the motor installed.) There's a rear cowl balsa former and a 1/16-inch plywood spinner ring (which initially fits tightly on the motor drive washer). To make the cowl, ample blocks of foam are fitted and glued to the fuselage area and around the motor. When all the foam is in place, it's carved and sanded to fair neatly into the spinner. Do note the aluminum airscoop details, etc.



The fuselage is narrow, but it's large enough for standard radios.

ALIGNMENT

With all the structures completed, it's time to mount the wing and stabilizer. Align the wing with the fuselage using the LE dowel and the rear attachment screw. Before drilling and tapping for the 8-32 screw, align the wing spanwise by equalizing the distances from each TE tip to the rudder post. For the stabilizer, position and install the rear attachment 6-32 screw; then equalize the distances from the center of bulkhead no. 2 to the elevator tips. Only after this is the forward screw installed.

With the wing and stabilizer in place, look at the assembly from the rear to verify that the stabilizer is aligned horizontally with the wing. If one side of the stab is higher than the other, adjust the fuselage mount by sanding it down with a sanding block. Note that such a narrow mount requires only a minute alteration.

You can also check the wing and tail incidence angles at this time. The lower edge of the fuselage box makes a good reference line. The angles should match the specs on the plan; if they don't, adjust them before proceeding.

Check the plane's balance; the CG shown on the plan isn't critical, but it does represent the best point. If CG adjustments are needed, move the batteries back and forth until the plane balances as it should. Just don't move the CG more than 1/2 inch fore or aft of the point indicated. (It was determined without the wing installed.)

COVERING

The cowl and the fuselage are covered with 1.5-ounce fiberglass cloth and epoxy resin as far back as the wing LE (one layer on the fuselage and two on the cowl). The entire model can be covered with a film of your choice. Coverite's* Black Baron film is easy to apply and needs no maintenance. It sticks at a low temperature setting and may even be applied in layers for trim. Nice stuff!

FLYING

Assuming that your Schwinge is properly aligned and that all the equipment is operating correctly, the first flight shouldn't be a problem. You *will* have to fine-tune it by making adjustments until it flies hands-off with both control surfaces at neutral. The power mode is tuned first. Obviously, any tendency to turn can be corrected by adjusting the rudder. (Rudder response is fast and positive.)

The degree of climb angle will depend on the amount of thrust your power supply produces. The greater the available power, the steeper the angle will be. When determining the best angle, remember that you don't want the model to "hang on the prop," so to speak. Instead, look for the steepest angle that has a decent forward speed. My Schwinge seems to do best at about 60 degrees. Use elevator trim to find the best angle.

Having determined the best climb angle, adjust stabilizer incidence to eliminate the need for elevator trim. If the climb angle is too steep, increase stab incidence (shim the LE up); if the angle is too shallow, reduce stab incidence by shimming the TE up. These adjustments increase or decrease stabilizer lift. A positive aspect of this procedure is that, having fine-tuned lift in this way, the proportions of wing and tail lift will be exactly right, and there will be excellent power control under all circumstances.

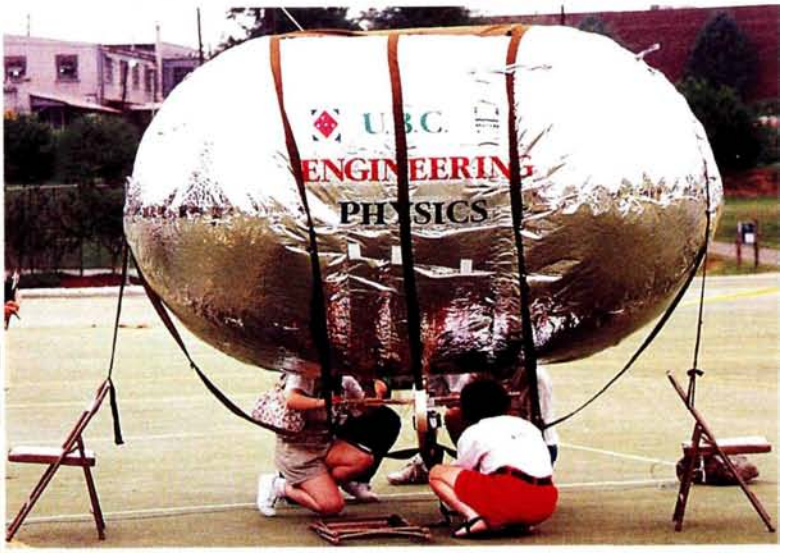
With the power mode fine-tuned, the next consideration is the glide mode. While adjusting the power mode, you may have to use elevator trim to attain a decent glide. For

(Continued on page 102)

The Navy's blimp floats out for a trial run.

3rd INTERNATIONAL Aeria

21st Century R/C?



Above: "It will never fly." But the builders swear that it did. Right, center: the University of British Columbia (UBC) blimp. Right: a test hover by the UTA tail-sitter.

Robotics COMPETITION

by JOHN A. GORHAM

Will 21st century R/C models have the capability to think for themselves? If they do, the International Aerial Robotics Competition may someday be regarded as one of the earliest demonstrations of such capability. Would you like to see these aircraft in action? Robert Michelson, president of the Association for Unmanned Vehicle Systems (AUVS), principal research engineer at Georgia Tech and organizer of the competition, tells us that the Fourth Annual Aerial Robotics Competition will be held on the Georgia Tech campus on May 19, 1994. "All are welcome." This includes local modelers! For more information, call (703) 524-6646.

FROM JUNE 24 to 26, 1993, the Third Annual International Aerial Robotics Competition was held on the campus of Georgia Tech in Atlanta. This meet is sponsored by the Association for Unmanned Vehicle Systems (AUVS) and Georgia Tech Research Institute. The meet is open to graduate and undergraduate students, with a $10,000 tuition award for the winning team and national recognition for their university.

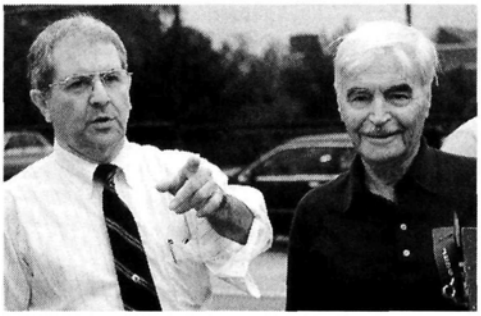
THE EVENT

The organizer of the event was Professor Robert C. Michelson, principal research engineer of the Aeronautics Department of Georgia Technical Research Institute and current president of the AUVS. The selected judges were Col. Bradford M. Brown of the Joint Project Office; Richard T. Wagaman, then president of the AUVS; and the author. The venue was a sports field on the Georgia Tech grounds.

Twenty-three teams from various universities registered, and nine participated in the competition. The original entrants included a team from Beijing University of Aeronautics and Astronautics, but, despite their strenuous efforts to come, they finally found it impossible to attend and participate. Several news crews were present, and eminent attendees included Vice Admiral Richard H. Truly, former administrator of NASA and now vice president and director of the Georgia Tech Research Institute, as well as many Georgia Tech department heads.

COMPETITION RULES

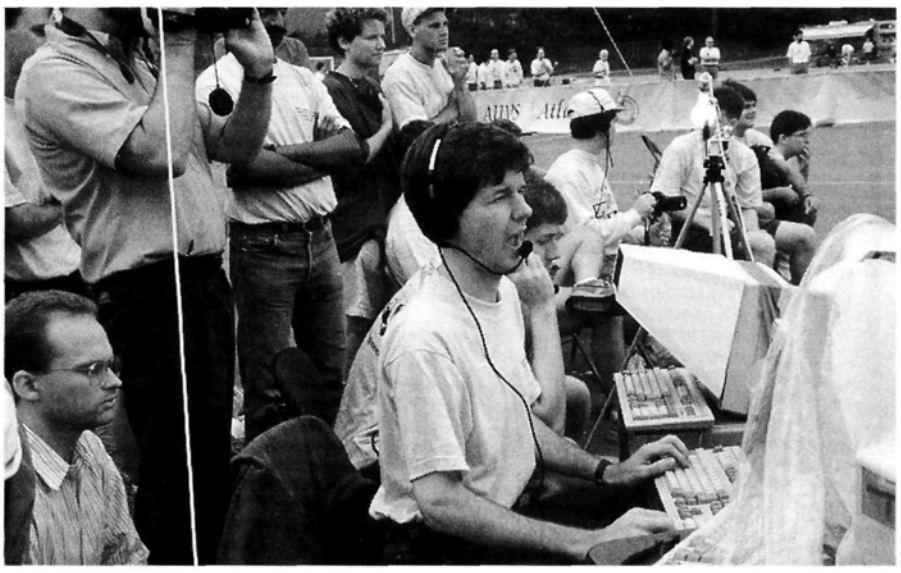
The competition requirements are to design and operate a purely autonomous air vehicle that can take off, maneuver to and hover over a nonmetallic tray (3 inches high and 6 feet in diameter) containing 10 mild steel and aluminum disks (each ½ inch high and 3 inches in diameter, with three ½-inch-diameter holes). The vehicle is then required to pick up one disk, transport it over a 3-foot-high barrier and deposit it in a similar tray on the other side. This task is to be repeated as many times as possible in the 60-minute time limit that was allotted to each team. Three adjacent arenas were set up, but activities were periodically halted so that only one team flew at a time.



Vice Admiral Richard H. Truly (left) and John A. Gorham, author.

VEHICLES AND SYSTEMS

The vehicles used by the students included six basic hobby helicopters (much modified), two balloons and one tail-sitter vertical-takeoff hover vehicle. The systems to generate the control signals for the task were obtained in many different ways with optical sensing of lateral position and ultrasonic altitude sensing being the favorites. Other lateral sensing techniques could include ultrasound, laser, radio triangulation, or Global Positioning System. Quite complicated and colorful computer ground bases to process the signals abounded. One of the helicopter entrants employed four helicopters ganged together (see photos). I did not see this one fly!



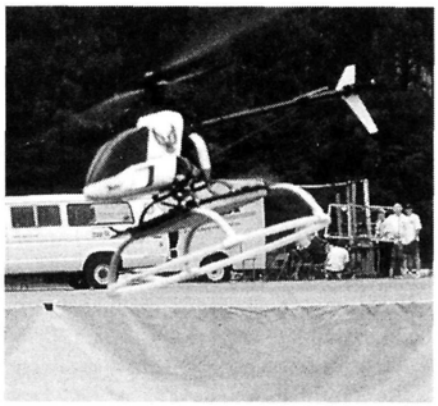
The complex ground station of the UTA team.

The balloons (blimps in the case of the Navy team) were designed to weigh just a tad more than the lift available (helium). A vertical-thrust electric or gas motor with a propeller was used to augment or reduce the lift to control altitude. Lateral maneuvering was accomplished by other electric propeller units suitably arranged on the vehicle.

The popular method for retrieval of the disks was to lower a small robot vehicle equipped with programmable steering wheels and sensors to "find" the target disks in the tray. The vehicle would then "explore" and lock on to a disk. With the disk, it would then be "winched" up to the main airborne vehicle to await a deposit in the target tray.

JUDGING

Points were based on a static judging that considered design elegance, innovation and safety. There were also points for the best T-shirt design! The competition point system for the flying was based on the ability to take off, the speed at which the disks were picked up and dropped off, successful (and accurate) landings, etc.



Here's the winning heli of the Georgia Tech team flown, when necessary, by Ken Mauragus (a local heli flier).

degree of enthusiasm, industry and, at times, humor. An autonomous takeoff would be vigorously applauded, and many groans accompanied runaways and crashes. Rain intervened a couple of times, but was not a serious impediment. Three of the teams managed to achieve autonomous takeoffs, hover and flight for 10 seconds plus, and two teams achieved autonomous landings. One team picked up a disk by using manual flight to position the helicopter but achieved an autonomous pick-up. The final outcome was that Georgia Tech team no. 1 and their helicopter were clear winners since they did pick up one disk. A close second and third were the U.S. Navy team no. 2 (blimp) and the U.S. Navy team no. 1 (helicopter). The tail-sitter of the University of Texas at Arlington team placed fourth. The judges finally decided that no one team had fully met the requirements this year, so the $10,000 was divided: $6,000 to the first-place, $2,500 to the second-place and $1,500 to the third-place winners. Curtis Youngblood, you don't have to worry yet—maybe next year! ■

1993 International Aerial Robotics Competition Competitors

DESIGNATOR	FULL TEAM NAME	VEHICLE TYPE
1. GA Tech no. 1	Georgia Institute of Technology Team no. 1	helicopter
2. GA Tech no. 3	Georgia Institute of Technology Team no. 3	four-rotor platform
3. MSU	Mississippi State University	helicopter
4. Navy no. 1	U.S. Naval Academy Team no. 1	helicopter
5. Navy no. 2	U.S. Naval Academy Team no. 2	neutral buoyancy
6. Southern Tech no. 1	Southern College of Technology Team no. 1	helicopter
7. UBC no. 1	University of British Columbia Team no. 1	blimp
8. UBC no. 2	University of British Columbia Team no. 2	blimp
9. USC	University of Southern California	helicopter
10. UTA no. 1	University of Texas at Arlington Team no. 1	tail-sitter
11. UTA no. 2	University of Texas at Arlington Team no. 2	tail-sitter

A very sad Andrew Fagg of USC contemplates his broken heli.

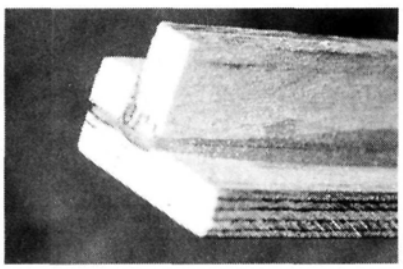
RESULTS

The competition was well-run and very exciting. The teams demonstrated a great

KEITH SHAW

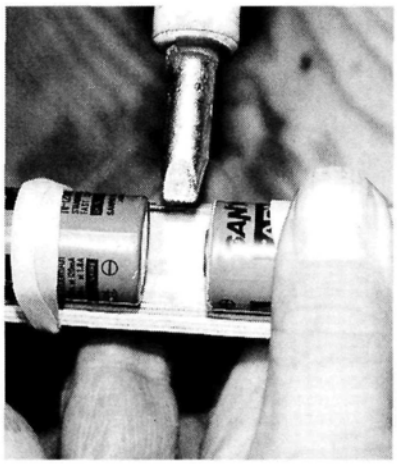
ON CONSTRUCTING AN IN-LINE BATTERY PACK

THIS MONTH'S COLUMN may seem an enigma, as I almost exclusively use the "stacked" configuration of cells for the Ni-Cd packs in my models. I wrote an extensive column on this method a few months ago, as I believe it to be the easiest, safest and most reliable way to make a battery pack. Although my scale airplanes rarely lack internal space (especially the Gee Bee R-1!), I do occasionally build a sleek pylon racer or sailplane. It may be virtually impossible to fit a stacked Ni-Cd pack into these skinny fuselages, so I have to resort to the in-line or "stick" arrangement of cells. Also, many kits and ARFs are designed for this configuration to utilize the abundantly available car packs. Most of these stick packs suffer the same shortcomings as the commercial stacked arrangements: thin sheet metal interconnects with poor or insufficient spot welds. For really good performance at high power, the cells need to be soldered together.



The assembly jig is made of ¼-inch plywood.

The in-line method of assembling cells does involve some risks and safety concerns. You *must* wear adequate eye protection as there is a chance that you might get hit with a fine mist of molten solder. Although this would cause little risk of a skin burn, it would be very dangerous for your eyes. It is also more difficult to control the heat input while soldering, so the Ni-Cds are at a higher risk of heat damage. I highly recommend that you get out your August '93 copy of *Model Airplane News* and re-read my column on Ni-Cds, since much of the information is also relevant to this technique.



PHOTOS BY DAN COGAN

Everything is ready to go.

GETTING EVERYTHING READY

To protect the cell from shorts caused by stray bits of solder or other conductive debris, a "bib" of heavy-duty masking tape will once again be applied. Use a sharpened piece of ⅜-inch-o.d. brass tube to cut a hole in the masking tape. Work on a piece of cardboard while holding the tape adhesive side up. The tape should fit snugly over the positive button of the cell, after which the excess can be trimmed flush to the edge of the case.

For best results, I suggest using cells without tabs, but if yours have them, remove as much of the tabs as possible and file off any remaining burrs. The cells will have to be tinned before assembly, so scrub both ends of each cell with Scotch-Brite, and use a zinc-chloride-based liquid flux, such as Stay-Clean. Carefully tin the positive button and an equal-size spot on the negative can end, using just enough solder to wet the surface. Excess solder will be expelled during assembly; this will make a mess and possibly be a safety hazard. Clean the ends with acetone or lacquer thinner to remove any traces of solder flux.

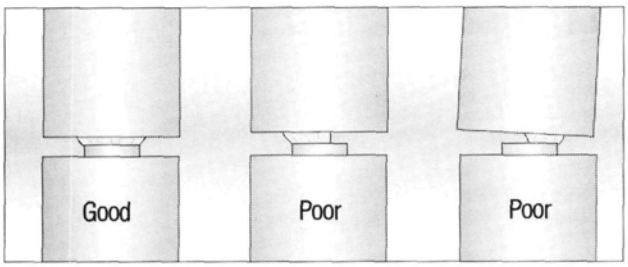
A simple assembly stage can be fabricated from ¼-inch plywood. Cut two 6-inch strips, one ½ inch wide, the other 1 inch wide, and assemble them with 5-minute epoxy and a piece of ¼-inch-square spruce to reinforce the joint. You could use a piece of ½-inch *wooden* corner molding if you can still find it, but everything I've found is formed plastic that would melt or break too easily.

The major difference with this technique is that the *sides* of the soldering-iron tip will be used rather than the point. It is necessary to tin the sides of the tip if it doesn't come that way. I use an Unger no. 4039 tip that is iron-clad, but I tin it anyway before use. Be sure that the iron has at least a 50W rating and a large chisel tip that's ¼ to 5/16 inch across. The Ungar no. 3310 element will also work well.

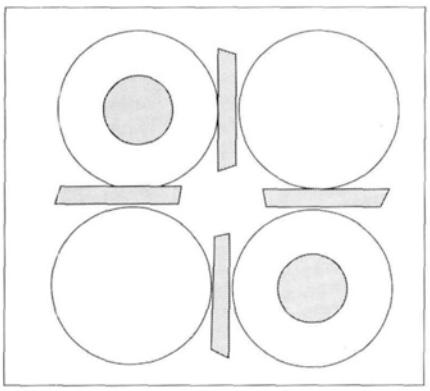
ASSEMBLING THE CELLS

Before going any further, you do have on your eye protection, right? Mount two cells on the jig with rubber bands and hold the jig so that your thumb pins down the lower cell while your index finger rests on the positive button of the upper cell. Have the cells

The sides of the iron contact the cells to melt the solder.



Inspecting a bond.



Glue strips of cardboard between the cell "sticks."

spaced just far enough apart to position the end of the soldering iron between them. Gently squeeze the top cell down so that the iron contacts the positive button of the lower cell and the negative can of the upper cell at the same time.

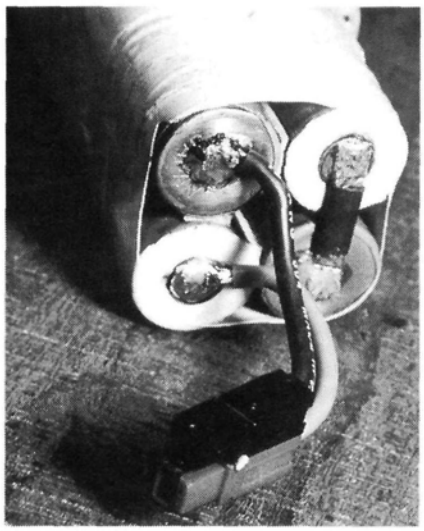
When the solder melts on both surfaces, quickly pull the iron out and press the cells together, holding everything still for a few seconds to be sure the joint has sufficiently cooled. Just before withdrawing the iron, change the orientation so that your eyes and face are out of the "line of fire." If there is too much solder on the cells and/or they are slammed together too hard, the excess solder will be expelled in a fine mist.

After completing each joint, remove it from the jig, and tap the side of the joined cells on the table to dislodge any fragments of loose solder. Check the joint by carefully wiggling it. You should also inspect it using a magnifying glass and a bright light. A good joint will have no spaces or incomplete bonds. A poor bond can be separated by rocking the cells to pop them apart. It can be very worthwhile to practice the motions with a cold iron to get the timing and mechanics down. Then the first few "hot" tries could be done with some old cells to gain confidence and to learn to minimize heat transfer.

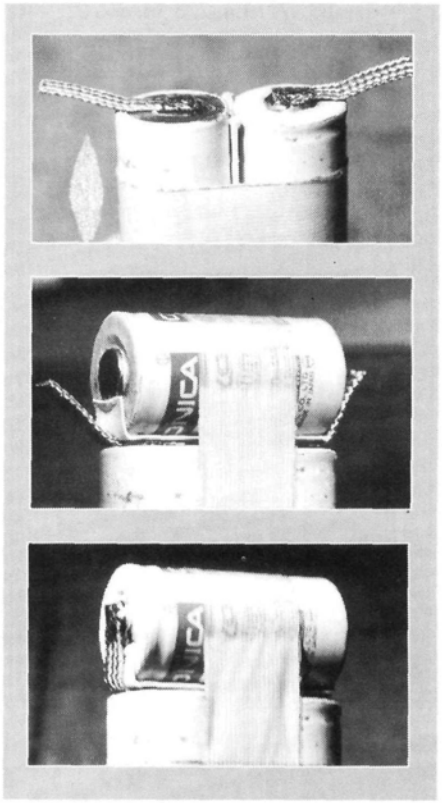
Continue adding cells until the desired stick "length" has been achieved. Since several of these sticks are bonded together to make the pack, some protection is necessary to prevent short circuits between them. The plastic shell on the Ni-Cds is not good enough, as I've seen it split or melt under traumatic conditions. Thin cardboard, such as cereal box or artist's railroad board, is quite a good insulator. Cut 3/8-inch-wide strips and glue them between the sticks using Walther's Goo or any good contact cement. The complete assembly can be stabilized with strips of strapping tape or by sleeving the entire thing with heat-shrink tubing. Finally, connect the sticks with heavy-duty copper braid, and attach the wire leads using the techniques discussed in the August column.

WHAT ABOUT THE ODD CELL?

No, not the orange one with the purple polka dots! I mean when an odd *number* of cells is required—most commonly seven. Although a stick of four cells and three cells could be bonded together, the most common practice is to mount the odd cell across the end of the pack. To do this, solder strips of copper braid to the end two cells, but facing away from each other (see photos). Attach the extra cell with a cardboard insulator, and hold it in place with a band of strapping tape. Make the cardboard insulator a little longer at the positive-button end for extra protection. Now fold the braid over the ends of the cells, cut the braid to length, tin it, and solder it into place.



This 20-cell pack powers the author's Horten IX.



The assembly sequence for adding an "odd" cell to the end of a pack.

Remember that the cells are *always* connected in series, so each joint is a connection between the positive button of one cell and the negative can of the next. If desired, a heat-shrink sleeve can go over the whole pack.

WHAT'S NEXT?

After all this, everyone should be an expert on Ni-Cd packs. Look for articles about mounting direct-drive and geared motors, testing connectors, wire, switches and fuses and perhaps some simple structural mechanics to help you design and build better electrics. If you would like to know more about a particular topic, write to me at 2756 Elmwood, Ann Arbor, MI 48104, and I will consider it for a future column. ■

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

by
FRANK PONTERI

IN THIS, the third and final segment of the Aeroplane Works/Ziroli AT-6 Texan kit review, I'll discuss painting techniques, final assembly and flight performance. Part 1 (in the June '93 issue) covers construction, and Part 2 (in the October '93 issue) covers the application of fiberglass cloth and epoxy resin in preparation for paint. After I wrote those articles, I decided to add a functional fuselage side hatch and a canopy fairing at the rear of the cockpit. I'll discuss these in detail in this article.*

SURFACE PREP

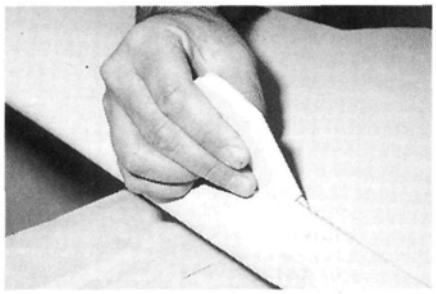
The model should be completely sanded with 120-grit paper and cleaned before it's painted. Remove any dust with a vacuum cleaner or a tack cloth. Use a household de-greaser to remove any body oil that results from handling the model; then, clean your hands with de-greaser. Any oil left on the model will affect the paint's ability to adhere properly, and it could make the paint peel.

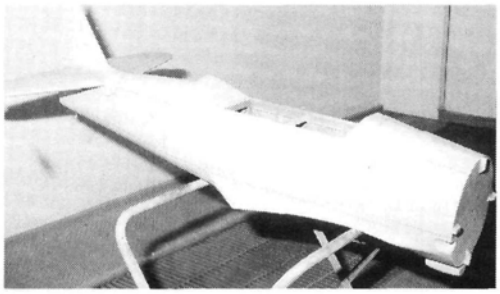
Prepping, painting, detailing and flying

AT-6 Texan

Aeroplane Works/Ziroli

PART 3



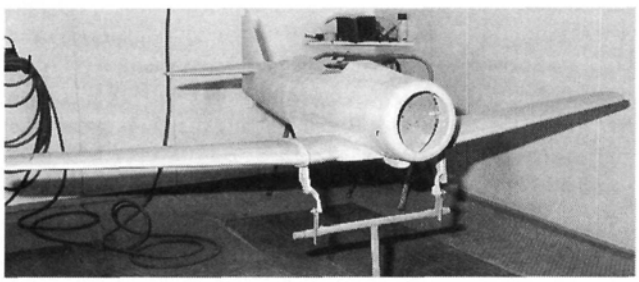


Left: after the second coat of primer has dried, draw the panel lines with a pencil; then apply 1/64-inch-wide chart tape to represent the panel lines on the finished model. A third and final coat of primer produces a recessed panel line when the chart tape is removed. Right: all the chart tape has been applied to the fuselage. Use photos or three-views to place the panel lines.

Apply a light coat of primer; this reveals any dents on the model. Fill the dents with pinhole filler and, when the filler has dried, sand it with 220-grit paper, and apply another coat of primer.

PANEL LINES AND SURFACE DETAILS

Use a pencil to draw the panel lines on the aircraft, and carefully place 1/64-inch-wide chart tape over these lines. Good-quality, three-view drawings or photos of the subject aircraft will have the most noticeable panel lines that you should reproduce. Chart tape comes in various widths, and it's available at office- and art-supply stores. After you've pressed the tape down firmly, apply a final coat of primer to the entire model, including the tape. When the primer has dried, lightly sand the primer that's on the tape until the tape is visible; then carefully remove the tape. Pull the tape back over itself; don't pull it at a right angle to the model's surface.



This paint stand holds the model by its landing-gear axles.

Before applying the paint, you can create raised panels or hatches with thin aluminum tape that's cut to the size of the panel. The tape has release paper attached to the sticky side, so it's easy to handle. They look very convincing when they're burnished down.

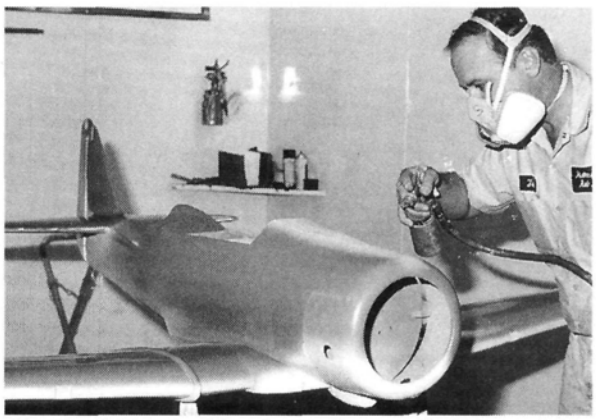
I installed the functioning fuselage side panel to add to the scale appearance of the model; the panel also hides the receiver on/off switch and the charging jack. To install the panel, I used a metal piano hinge from Scale Aviation* and a spring-loaded hatch pin from Bob Violett Models*. The rear of the plastic canopy (supplied by Nick Ziroli) has the rear fairing attached. I decided to remove this portion of the canopy and build up this detail on the fuselage for an improved scale appearance. After this had been completed, I attached the canopy to the fuselage with Du-Bro* no. 2x1/4-inch button-head screws.

PAINTING

I used Sikkens automotive enamel primer and paint—a base coat/clear coat type of paint. The color, which is applied first, has a dead-flat finish. The gloss is obtained when the clear coat is applied over the color coat. The amount of gloss depends on the clear you select: dead-flat, low-gloss or high-gloss finishes. I used low gloss on this model.

To paint the model, I used a stand that holds the plane by its landing-gear axles (see photo), an automotive spray gun and a compressor. Always use the proper safety precautions when you spray any paint. I strongly recommend that you read *all* the instructions that come with the paint. Spray your model in a clean, dust-free area away from anything that produces sparks or flames. Use a canister-breathing mask, and make sure that you have plenty of ventilation.

My model was sprayed in a professional spray booth. I started with the light color first (the white underside) and, when it was dry, I turned the model over and applied the blue color on top. I blended the blue into the white for a camouflage effect, and I made the demarcation line soft. Then, I masked off the anti-glare panel, the wingtips and the canopy and painted them after the blue had completely dried.

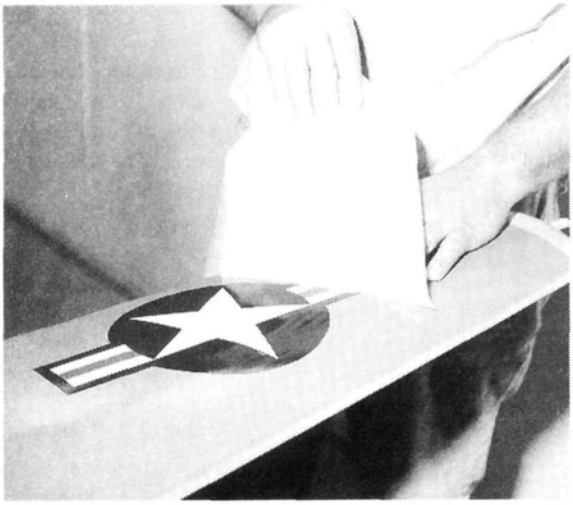


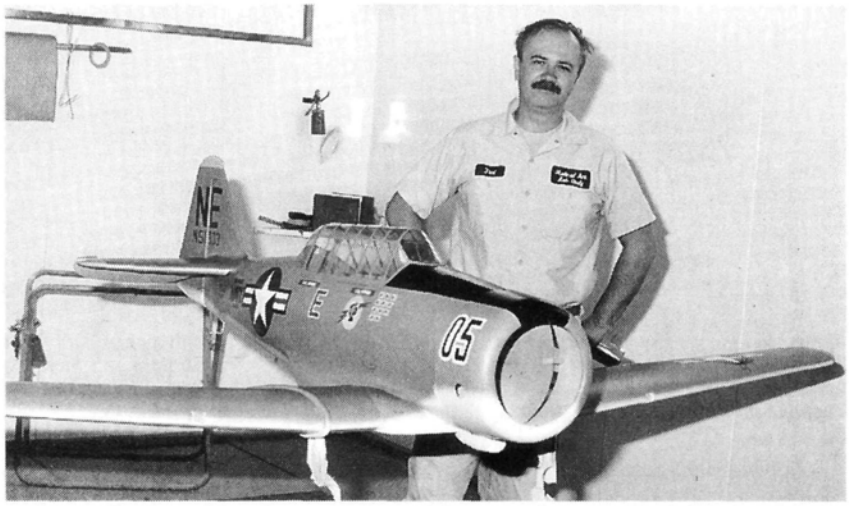
After the light underside color has been applied, the model is turned over and the darker, top-side color is applied. The two colors have a soft demarcation line.

SPECIFICATIONS

Type: 1/5-scale giant warbird
Wingspan: 101 in.
Length: 70 in.
Weight: 28.25 lb.
Wing area: 1,500 sq. in.
Wing loading: 43.4 oz. per sq. ft.
No. of channels req'd: 6 (aileron, rudder, throttle, elevator; flaps and retracts optional)
Airfoil: semisymmetrical
Wing construction: wood
Fuselage construction: wood
Washout built in?: yes
Engine used: Zenoah G-62
Prop used: 22x6/10
List price: complete kit $325; $175 for tail and wing kit

Features: all parts are hand cut and sanded. The kit includes all the balsa, the plywood and the hardwood and balsa sheeting for the wing and the fuselage, an aluminum spar tube, elevator joiner wire and wing ribs. Hardware not included. Plans and plastic parts, e.g., fiberglass engine cowl and clear plastic canopy, are available from Nick Ziroli Plans*



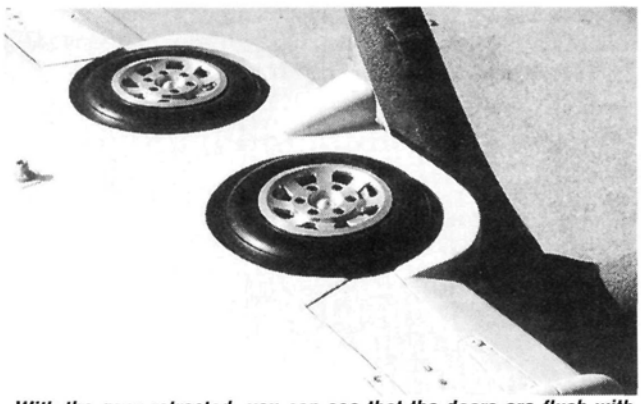


Left: the Model Graphic markings come on carrier paper, which makes application quick and easy. Right: Fred Stagg stands next to the finished model. The markings and color scheme were found in the book "The AT-6" by William Jesse. Model Graphics did a great job of matching the markings.

SCALE MARKINGS

I found the original photo for the model's paint scheme in a book called "The AT-6" by William Jesse. Most of the decal markings for the aircraft were supplied by Model Graphics*. Butch Andrews does a great job of making the graphics to scale. The markings are the vinyl or stick-on type, and they come with carrier paper for easy application. A mixture of water and liquid soap is used to wet the surface where the decal is to be placed and, once the decal is in position, the liquid and any air bubbles are easily squeegeed out. For the best results, follow the instructions included with the graphics.

After all the markings had been applied, I applied a coat of flat clear to seal the markings and to give the plane a realistic appearance.

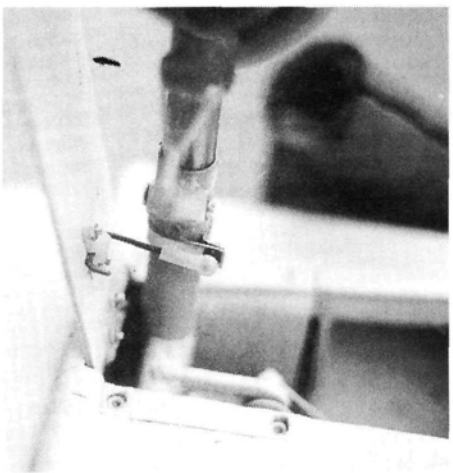


With the gear retracted, you can see that the doors are flush with the wing's undersurface.

SCALE ACCESSORIES

I installed a dummy radial engine (available from Frank Tiano Enterprises*), which is molded out of resin. I put it in the cowl using strips of 6-ounce fiberglass cloth applied to the cowl and the rear of the cylinder heads. Prior to installation, I painted the engine flat black and added ⅛-inch-diameter aluminum tubes to simulate the pushrods and the spark plugs. Not only did this enhance the model's appearance, but it also filled up the cowl and hid the Zenoah.

The landing-gear doors are made of ⅛-inch plywood and are connected to the landing-gear strut with a plastic ball link and a length of threaded pushrod. A strip of flat brass was wrapped around the landing-gear leg, which has a ball-link ball attached to it. The ball link and the threaded rod are attached to the gear door with a plastic landing-gear strap. The doors (hinged to the wing with a regular, flat, plastic hinge) close nicely, and they sit flush with the bottom surface of the wing when the gear is retracted.



Here's a close-up of the landing-gear door attached to the retract strut. A ball link and a metal strap around the strut connect it to the door.

The aluminum wheel hubs shown in the photos are strong, and they look great. They can be purchased from Walker Machine*. The tires are from Byron Originals*, and the hubs are made to fit the Byron tires.

FINAL ASSEMBLY

For power, I used a B&B Specialties* modified Zenoah G-62, which includes a CH electronic ignition system. To keep the weight of the ignition system as far forward as possible and to keep it away from the radio, I made a shelf out of plywood, installed it above the engine and attached it to the firewall. The shelf supports the ignition module and the Ni-Cd drive battery. I also installed a J'Tec* AT-6-style muffler. The exhaust exits at the scale location. The JR* X-388 FM computer radio that I used had the following servos:

- three 517 servos for the flaps that were converted to 180-degree rotation operation by Ocean County R/C Service*;
- one 517 servo each for the engine and the retracts;
- one 4131 servo for the rudder;
- two 4131 servos for the elevator (one for each half);
- two 4131 servos for the ailerons (one for each control surface).

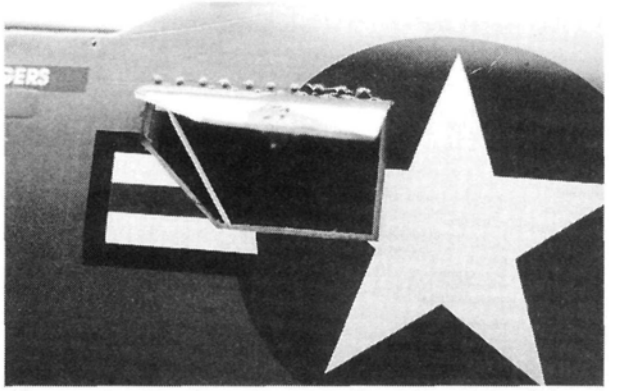
To power the radio, I installed a 2200mAh, 6V battery from Model Aviation Technology*.

A dome spinner from TruTurn* com-

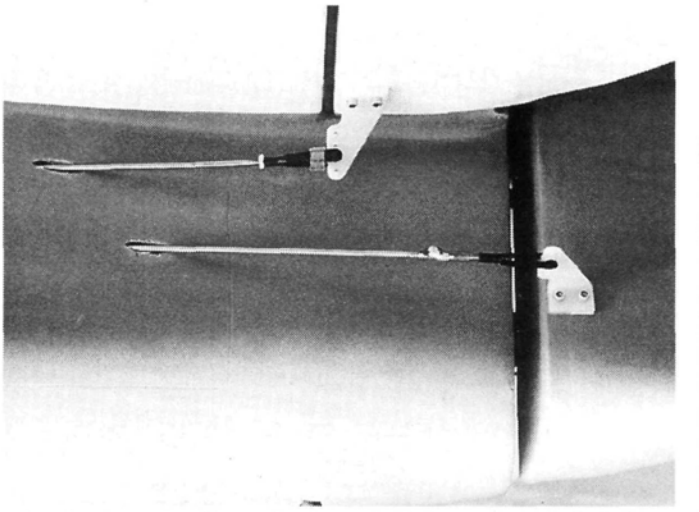
THE ZIROLI AT-6 HAS BEEN AROUND FOR A NUMBER OF YEARS AND, IN THE HANDS OF AN EXPERIENCED GIANT-SCALE PILOT, WILL POSE NO PROBLEMS WHATSOEVER.

pletes the aircraft. The spinner is made of aluminum bar stock, and it has an aluminum backplate. TruTurn has prop-nut adapter kits for all the major brands of engines, and their spinners come in many shapes and sizes.

I installed all the radio gear as far forward as possible in the aircraft because the short nose moment can make the Texan tail heavy. I used a large battery pack since I would rather carry battery power than lead weight. All of the Robart* retract components, i.e., the air valve, the two air tanks, the air line, the retracts and the servo are contained in the wing. This arrangement eliminates the need for quick disconnects in the air lines, which would normally be the case if the servo, the valve and the tanks were installed in the fuselage. Without any quick disconnects in the retract air system, the chances for air leaks and retract failure is greatly reduced. The completed aircraft, less fuel and ready to fly weighs 28.25 pounds.



The completed fuselage side hatch. The radio on/off switch and the charging jack are inside.



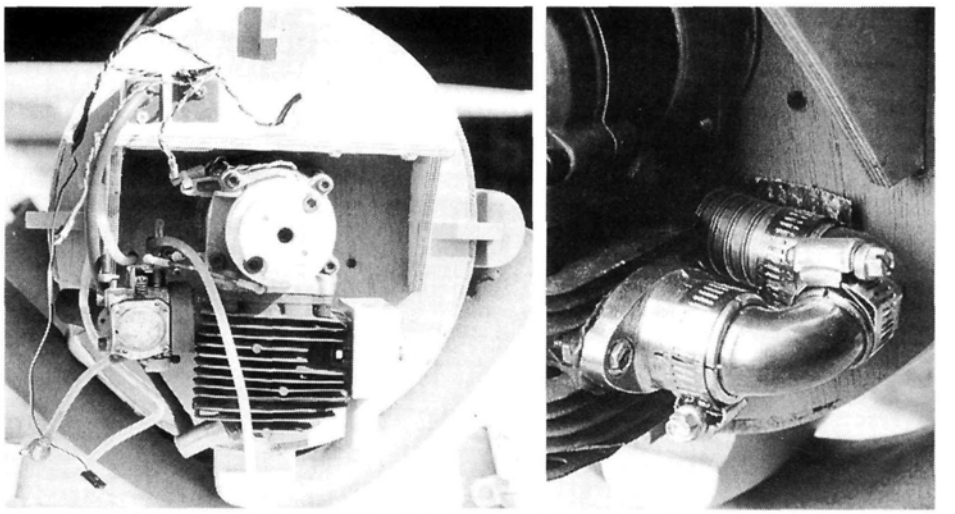
The elevator and rudder pushrods are 4-40 size, and small clevis keepers (short lengths of fuel tubing) are used for added security.

FLYING THE TEXAN

The Ziroli AT-6 has been around for a number of years and, in the hands of an experienced giant-scale pilot, will pose no problems whatsoever. I used a 22x6/10 propeller and fed the G-62 a 50:1 fuel mixture. The Texan seems to like this prop, and it had no bad habits during flight, though it likes to land on the main landing gear with the flaps down. Remember, this is not a pattern aircraft; however, it will do all the scale maneuvers capable of its full-size counterpart.

I would like to extend a special thank-you to Walter Chubb and Fred Stagg for their assistance with this review.

The servos are mounted on hardwood rails in the fuselage center section. I also used a 2200mAh battery pack installed forward in the fuselage to help balance the model.



The Zenoah G-62 engine is installed inverted. A plywood shelf above the engine holds the CH electronic ignition system and the drive battery. Keeping it outside on the firewall and away from the radio is good insurance against radio interference. Above right: the new J'Tec AT-6 Texan exhaust system shown here is available in inverted and 45-degree engine-mounting styles.

*Here are the addresses of the companies mentioned in this article:

Aeroplane Works, *2134 Gilbride Rd., Martinsville, NJ 08836.*

Scale Aviation; *distributed by Cirrus Aviation, 115 Hunter Ave., Fanwood, NJ 07023-1030.*

Bob Violett Models (BVM), *170 State Rd. 419, Winter Springs, FL 32708.*

Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.*

Model Graphics, *121 Cove Rd., Hemphill, TX 75948.*

Frank Tiano Enterprises, *15300 Estancia Ln., W. Palm Beach, FL 33414.*

Walker Machine, *517 N. Elizabeth, Milton-Freewater, OR 97862.*

Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*

B&B Specialties, *14234 Cleveland Rd., Granger, IN 46530.*

J'Tec, *164 School St., Daly City, CA 94014.*

JR Remote Control; *distributed by Horizon Hobby Distributors, P.O. Box 3726, Champaign, IL 61826.*

Ocean County R/C Service, *212 Atlantic City Blvd., Beachwood, NJ 08722.*

Model Aviation Technology, *12848 Touchstone Place, Palm Beach Gardens, FL 33418.*

TruTurn, *P.O. Box 836, South Houston, TX 77587.*

Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*

Nick Ziroli Plans, *29 Edgar Dr., Smithtown, NY 11787.* ■

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

Lanier Laser 200

by JIM ONORATO

QUICK-BUILD STINGER TECHNOLOGY IN A ¼-SCALE FAVORITE

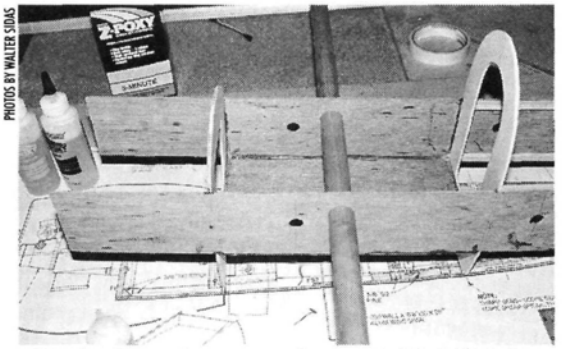
IF YOU'VE EVER seen a full-scale Laser flown at an air show, you know what a fantastic flying machine it is. I've watched them being put through their paces several times and, each time, just marveled at the aerobatics capabilities of these aircraft. Then I'd go to our flying field and eat my heart out watching my fellow modelers perform similar feats with their big ⅓-scale beauties. (I have not yet ventured into anything beyond ¼ scale.) Needless to say, I was happy to see Lanier RC* come out with an IMMA-legal ¼-scale Laser and delighted when *Model Airplane News* asked me to review it.

THE KIT

The label on the kit box says, "Fast assembly with minimum parts." When I opened the huge box I could see what Lanier meant. The foam wing-cores and various vacuum-formed plastic parts made up most of the contents, and there just weren't very many wooden parts in there.

The kit does not contain any hardware, but it does include a complete list of recommended hardware. (Modelers often elect not to use the kit-included hardware because they have other preferences, or they prefer a higher grade of hardware. Lanier's approach is certainly very practical.) The 11-page instruction booklet consists of well-written, step-by-step instructions, but does not include any photos or sketches. The two sheets of rolled plans are excellent and full of detail.

PHOTOS BY WALTER SIDAS



The aluminum wing spar can be seen in this initial stage of fuselage construction.

SPECIFICATIONS

Name: ¼-scale Laser 200 (no. 93217)
Manufacturer: Lanier RC
Type: scale/aerobatic
Wingspan: 72 in.
Wing area: 855 sq. in.
Airfoil: symmetrical
Weight: 10 lb., 12 oz.
Wing loading: 29 oz./sq. ft.
Length: 44¾ in.
Radio: 4-channel, 6 servos
Engine range: .60 to 1.08 2-stroke, .91 to 1.20 4-stroke
Engine used: O.S. 1.08 FSR
Propeller: 15x8 Master Airscrew*
List price: $249.95 (discount price: $159.95)

FEATURES: designed by Bob Godfrey (two-time TOC design champion) this design has balsa-sheeted-foam wing panels; fully symmetrical airfoil; plug-in wings with aluminum spar; built-up tail assembly; vacuum-formed turtle deck, wing cover and canopy; hefty preformed aluminum landing gear; ABS cowl and wheel pants; built-up fuselage with die-cut lauan plywood sides; die-cut lite-ply parts and bulkheads; rolled full-size plans.

HITS
- Excellent flight performance and low-speed stability.
- Easy-to-follow plans and instructions.
- High-quality foam-cores.
- Good-looking overall appearance.

MISSES
- No hardware included.
- Engine compartment open to fuselage interior.

CONSTRUCTION

I used Pacer Technology's* 30-minute Z-Poxy to attach the wing skins and 5-minute Z-Poxy on most of the plywood fuselage parts. I used Pacer's Zap, Zap-A-Gap and Slo-Zap CAs and Zip Kicker accelerator for everything else. Pacer's Z-Ends were very useful for dispensing small amounts of CA and for keeping the tips of the containers unclogged.

WING

The wing is double tapered with a symmetrical airfoil. The wing panel foam-cores are precut and have to be handled very carefully because of the delicate, feathered trailing edges.

I used 5-minute Z-Poxy to glue in the fiber wing spar tubes and the two plywood servo trays. You have to be sure to install the servo trays in the bottom of the wing. It is possible to install them incorrectly because the square hole in the foam-core goes all the way through.

The wing panels were sheeted with 3/32-inch balsa. I trued up all the edges of the balsa sheets using a long steel straightedge and edge-glued three 4-inch sheets and one 3-inch sheet with Zap to make up each of the four wing skins. The skins were attached with a very thin coat of 30-minute Z-Poxy. While the epoxy was curing, I placed the sheeted core in its foam packing pieces and placed this "sandwich" on my pool table. I then covered it with a piece of wood of the appropriate size, added six 5-pound bags of lead shot and let the epoxy cure overnight. All four skins were applied in the same manner.

Remaining work on the wing panels consisted of attaching the leading edges, root and end caps and cutting out the ailerons. I placed the wing panels in their mating foam packing piece when I cut out the ailerons with my handsaw. This kept things nice and square. The exposed edges were then covered with balsa according to the instructions. The wing was completed by installing the ¼-inch dowel alignment pins. When I had finished, both wing panels were perfectly straight. The 30 pounds of lead shot really did the job!

TAIL GROUP

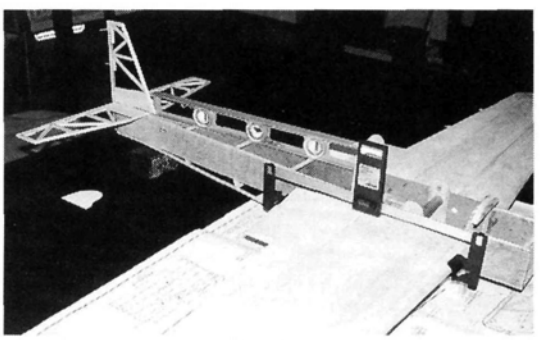
Building the tail is straightforward. It is built up with ¼-inch balsa strip wood and some ¼-inch balsa sheet parts. A piece of ⅛-inch lite-ply is used to reinforce the fin post. I used Robart* hinge points for the rudder and elevator hinges. The instructions tell you how to make a simple, yet handy, gauge to help you get the hinge-point holes lined up properly. This worked out very well.

Slices of ¼-inch dowel were inserted into the fin to reinforce the points where the tail struts would be attached later. The stab and elevator halves were built the same way as the fin and rudder. The elevator halves are not joined because each half is controlled by its own servo.

Do not attempt to fly the Laser without tail struts. You can build and install them with the hardware called for on the plans, but I found them rather heavy. I used 1/16-inch wire and soldered mini terminal lugs instead. (See the section on balance.)

FUSELAGE

Construction of the fuselage is also simple and straightforward. The lower section is made mostly of ⅛-inch plywood with ¼-inch-square balsa strip wood for longerons and cross-braces. The plans call for lite-ply, but my kit contained lauan plywood for the sides and most of the forward section. This material is heavier than lite-ply made of poplar, and it has a very coarse grain. I used 5-minute Z-Poxy to glue



Wing incidence is set with a Robart Incidence Indicator.

FLIGHT PERFORMANCE

• Takeoff and landing

The first flights were off a closely cut grass field on a calm day. I set up my transmitter so that "high" rate gave the recommended throw on all control surfaces and "low" rate gave about 50 percent. I pointed the Laser down the runway, applied a little up-elevator to keep the tail down and advanced the throttle. The Laser tracked as straight as an arrow with just a touch of right rudder. Flying speed was attained quickly, and the Laser lifted smoothly into the air after rolling only about 25 feet. I relaxed the rudder, and the Laser began a 30-degree ascent with its wings perfectly level. A long, banking turn brought the plane back over the middle of the field and, much to my surprise, it flew perfectly straight and level without my having to make any trim adjustments. (I know we've all heard that before, but it did really happen that way.)

Landings are about as gentle as I've ever seen. The Laser slows way down and has an exceptionally shallow glide slope that allows the plane to descend very slowly. A slight flare just before touchdown results in very smooth three-point landings.

• Slow-speed performance

The Laser is smooth and predictable at slow speeds. It has a very low stall speed, and its stalls are quite gentle. The plane can be flown at a very slow speed without any loss of stability, and it can execute all but vertical maneuvers at part throttle. The Laser safely flies slowly!

• High-speed performance

At high speed, the Laser is a go-where-you-point-it airplane. It tracks extremely well and is a very smooth, stable flier. The only problem I encountered was high-speed tip-stalling when I applied full up-elevator while in high rate. Using low rate eliminated this problem. The elevator control throws were 1⅛ inches at high rate, which is simply too much throw, and ⅝ inch at low rate. The Laser performed perfectly well with the elevator at low rate. The O.S. 1.08 pulled the Laser straight up.

• Aerobatics

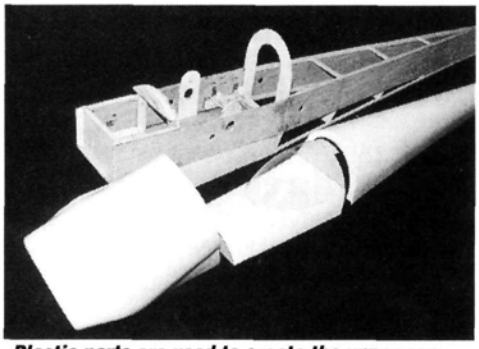
The Laser was designed for aerobatics, and it performs this task in an outstanding fashion. Inside and outside snap rolls are incredibly fast and can be done with the plane heading upward, downward or level; it doesn't seem to make any difference. Axial rolls were a little slower than I expected, but a little more aileron throw should improve the roll rate. Sustained knife-edge and outside 360-degree turns were no problem for the Laser. I used all three controls for spin entry, and when the controls were neutralized, the Laser recovered within one quarter spin. As indicated above, the Laser had a tendency to roll out of high-speed loops (with excess elevator deflection) until I switched to low rate. I was really impressed when I rolled the Laser to inverted flight and it flew hands-off just as straight as an arrow.

The aerobatic capabilities of this airplane are truly outstanding. All I have to do now is improve my flying ability so I can take advantage of them. I really like this airplane!

most of the plywood parts, and I used a carpenter's square to keep the bulkheads square and perpendicular to the fuse sides while gluing.

In my kit, bulkhead F2 was incorrectly marked "F1," but it was pretty obvious which part was which because of the shape. (Lanier has now corrected this problem.) When gluing the second side of the fuse to the bulkheads, I found it useful to insert the aluminum wing spar through the sides to make sure it was level and perpendicular to the fuse.

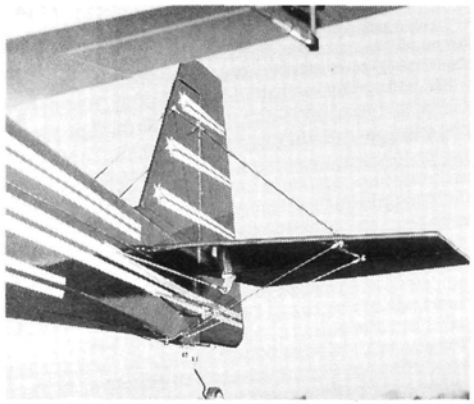
The two fuselage sides have to be scored half way through at the aft edge of F3 then cracked and Zapped to make the sides straight from F3 aft. This is required to get the turtle deck to fit properly. Be careful not to break the sides completely in two!



Plastic parts are used to create the upper contours of the Laser's fuselage.

necessary modification to the front of the fuse. According to the plans, the area on top of the fuel tank between the firewall and F2 is supposed to be left open. This would leave the plane's interior open to the engine compartment, and air entering the front of the cowl would carry fuel and oil to the inside of the plane where the radio is. I covered this area with a piece of lite-ply that not only isolates the engine compartment from the rest of the fuse, but also strengthens the top edge of the firewall.

Next, I installed the servo rails and built the wing cover frame. The cowl, wheel pants, wing cover and turtle deck are all ABS plastic and give the plane that sleek Laser look without very much effort on the part of the builder. These parts were painted and attached after the fuse had been covered.



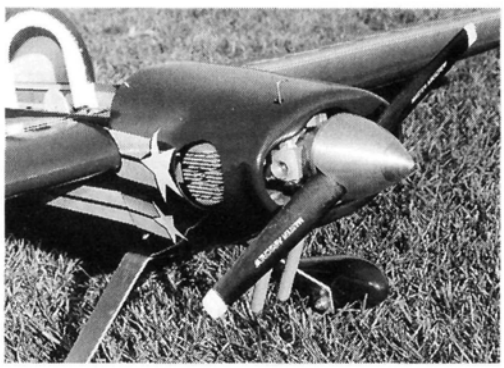
Note the sturdy rigging that supports the tail feathers.

Before installing the firewall, I laid out the engine-mount mounting holes and installed blind nuts. Then I positioned the firewall to accommodate my engine and mount and epoxied it into place. Because engines come in many sizes, you may have to alter the fuse sides. Leave the cowl length as is, and alter the sides to fit your engine and mount setup.

Lanier recommends .60 to 1.08 2-stroke engines or .91 to 1.20 4-stroke engines for the Laser. I used an O.S.* 1.08 FSR, which is a powerful, two-stroke that's capable of pulling the Laser straight up. I feel certain that a smaller engine, though maybe not giving the vertical performance or speed of the 1.08, would still give perfectly acceptable performance.

I made what I felt was a necessary modification to the front of the fuse. According to the plans, the area on top of the fuel tank between the firewall and F2 is supposed to be left open. This would leave the plane's interior open to the engine compartment, and air entering the front of the cowl would carry fuel and oil to the inside of the plane where the radio is. I covered this area with a piece of lite-ply that not only isolates the engine compartment from the rest of the fuse, but also strengthens the top edge of the firewall.

A Robart Wing Incidence Indicator should be used to set the wing incidence which, by the way, is 0 degrees. If you don't own one, borrow one from a friend. This is a critical step. Please note that when setting the incidence of the second wing half, part FS3 should be installed first, and the 4-40 socket-head retaining bolt should be installed last.



Note how well the O.S. 1.08 fits in the Laser's cowl.

FINISHING

I finished the Laser with Coverite's* 21st Century fabric, spray paint and graphics (stars). This is the fourth model I have finished with these products, and I continue to be very pleased with the results. The colors I used are dark blue and cub yellow with white stars. Coverite's dark blue spray paint does not match their fabric very well, but I managed to get an acceptable match by first applying a coat of black before spraying on the dark blue. The white stars on the fuse and tail feathers are Coverite stick-on graphics. The stars on the wings were cut out of 21st Century fabric and ironed on.

BALANCE

I placed the radio battery alongside the fuel tank, directly behind the firewall, the receiver just behind bulkhead F2 and the servos where shown on the plans. With this configuration, the Laser was quite tail-heavy, so I replaced the tail struts with lighter ones made of 1/16-inch wire and miniature terminal lugs.

I also replaced the tail-wheel with a simpler, lighter one than that shown on the plans. All in all, I figure I saved about 1½ ounces in the tail, and that reduced the amount of nose weight required to balance the plane by 6 ounces. It is important to note that the tail moment is four times the length of the nose moment, so every extra ounce in the tail requires 4 ounces in the nose to counterbalance it. As it was, I still had to add 8 ounces of lead to the engine compartment to get the CG to come out where shown on the plans. I know the use of fabric instead of film covering contributed to the tail heaviness, but it was a price I was willing to pay. As far as I can tell, the extra weight does not hurt the Laser's flying performance one bit.

CONCLUSION

The Laser kit is easy to build, looks great, is very aerobatic and has good low-speed stability. I thoroughly enjoyed building and flying this airplane and highly recommend it for intermediate and advanced fliers. The Laser is one of the best-flying airplanes I have ever built!

**Here are the addresses of the companies mentioned in this article:*

Lanier RC, *P.O. Box 458, Oakwood Rd., Oakwood, GA 30566.*

Pacer Technology, *9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*

Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*

O.S.; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*

Coverite, *420 Babylon Rd., Horsham, PA 19044.*

Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.* ■

MODEL AIRPLANE NEWS MAGAZINE

FIELD & BENCH REVIEW

M.A.P. Aura 2 Sailplane and Aveox Brushless Motor

by TOM HUNT

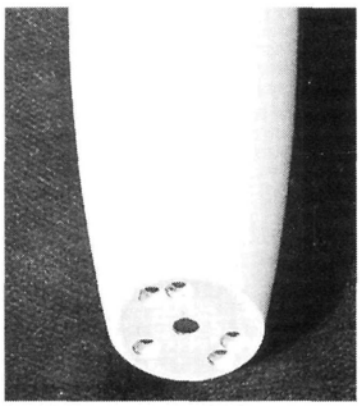
PART 1

Editor's note: in this combined review of the Aveox brushless motor and the Model Airplane Products Aura 2 sailplane, Grumman aerospace engineer and contributing editor Tom Hunt takes a close look at these well-matched examples of leading-edge modeling technology. In Part 1, Tom provides a brief introduction to the all-composite, ready-to-fly Aura 2 and then reports on the test-stand performance of the remarkable, new Aveox 1412/7 motor. In Part 2, he discusses final assembly of the Aura 2, the motor and control-system installations and flight performance.

High technology for electric flight

STATE OF THE ART: an overused expression that means the latest and greatest (sometimes regardless of cost). The subjects of this combined review—the Aveox* brushless motor and the Model Airplane Products* Aura 2—are recently introduced products that should be considered "top of the line," "finest quality" and "superior performance," but "state of the art"? Definitely!

They form one of the most efficient powerplant/airframe packages that I have ever experienced. That's not to say that this combination will win F5B (old designation: F3E) contests, but it will allow the modeler to quickly experience (owing to the extensive pre-fabrication) what has taken serious competitors many years to develop. Although the initial investment is high, many years of outstanding performance can be expected from these products without further investment.



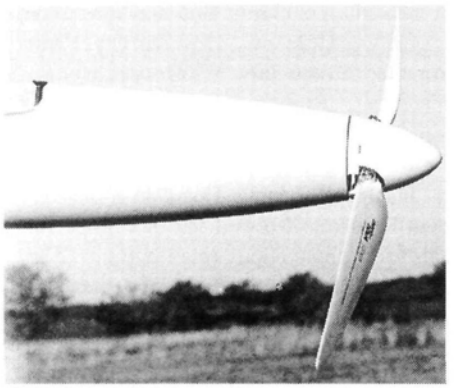
The mounting plate for the motor. The hole spacing is for the more popular German motors, but there's enough room for most American types.

THE AIRCRAFT

Before taking a close look at the Aveox, I'll provide some background on the Aura 2. Made by Model Airplane Products (M.A.P.) of France, the Aura 2 is a ready-to-fly, 2-meter, 10- to 27-cell F5B-class electric sailplane. Completely prefabricated, it only requires motor and radio installation. This took me less than six hours to complete on one weekend. The model is also offered with a lighter, hollow-core wing for maximum 10-cell operation for the same price.

The fuselage, which has a molded-in vertical tail, is a factory-joined Kevlar/gelcoat lay-up with an installed motor mount (a fiberglass front disk). It weighs 5 ounces when it's empty. This is a tremendously tough, light fuselage. (Remember, this model can accept up to 27 cells. That's a lot of lead to fly and land with!) The wing fillet and saddle are molded in, and each wing is hand-fit to match its fuselage. (A removable, color-coded dot on the wing matches one on the fuselage to ensure that the correct wing goes with the correct fuselage. A similar arrangement is used for the T-tail horizontal.)

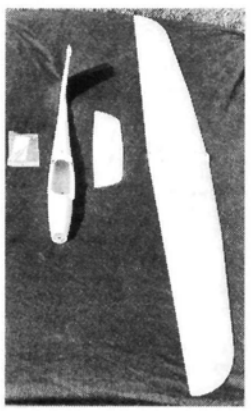
The wing is molded in one piece; it spans nearly 2 meters from tip to tip and has approximately 500 square inches of area. It uses an SD7003 airfoil from root to tip. No specifications on washout are given, and from its appearance, none has been introduced. The wing sports a straight trailing-edge,



This Carl Goldberg* 1.75-inch spinner and the Aeronaut* 11.5x7 prop were used for the initial flights. Slegers Intl. offers a special spinner for the Aura.

multi-taper planform that's similar to the Schuemann wing planform, which is very popular today.

Factory construction of the 27-cell wing involves a now common (and very labor-intensive) method in which parallel rows of long, narrow, carbon-fiber strips (about ⅛ inch wide, spaced every ⅜ inch along the top and bottom of the chord) are placed over the white foam-core. These strips run lengthwise along the wing. Fiberglass is laid up over the carbon-fiber strips. The "paint scheme" is impregnated in the fiberglass (color choice is limited).



The supplied parts.

The assembly is then put into a high-quality mold to cure. When the wing is extricated from the mold, the seams are hard to find. The surface is as smooth as polished metal, and the overall appearance reminds me of some of the finest surfboards I have ever seen.

The model has no provisions for a rudder, and none is needed for good flight performance, although you could cut off the rear of the fiberglass vertical tail and replace it with a built-up rudder. I'll provide more detail on the construction and assembly of the kit and its performance in Part 2 of this article.

THE AVEOX BRUSHLESS MOTOR

The Aveox DC brushless motor, model no. 1412/7, is a 7-turn, 9- to 16-cell motor that comes with its own, special, 5- to 16-cell, 50A-max speed controller. This brushless motor boasts considerably higher efficiency, a longer life and lower maintenance than brush motors of similar size. Its disadvantages include slightly higher weight and cost, but with time, I'm convinced that these, too, will decrease. For those of you who aren't familiar with this type of motor, let me briefly explain how it works.

This motor differs from most brush motors in that the windings are attached directly to the inside walls of the "can." In a brushless motor, the magnet spins in the middle, which is the converse of a brush motor. Brush motors spin the windings, i.e., the armature, in the middle, and the magnets are rigidly attached to the inside wall of the motor can.

The brushless configuration has many advantages; increased efficiency is probably the most obvious. With no brushes to skip over the armature and increase resistance and heat, efficiency is gained. Since the magnet, which is attached to the shaft, is near the center of the motor (and has a lower mass than an armature in a conventional motor), higher rotational speeds can be achieved. Another distinct advantage is that the windings (the things carrying all those hot little electrons) are near the outside of the can and can radiate the heat that's generated more efficiently. Possibly the most important advantage is that without brushes causing "arcing" from the brush to the commutator, electrical "noise" is reduced, and this, in turn, considerably reduces the likelihood of receiver glitches.

But how does one get those hot little electrons to spin the magnet without brushes? That's where the special speed controller comes in. It converts the DC output from the battery to three-phase AC output that sequentially powers separate segments of the windings; this causes the magnet to spin. (Hey! Leave me alone, I'm a mechanical engineer, not an electrical engineer. If you need a better explanation, call the folks at Aveox, and they will give you all the theory you want.)

I should point out that brushless motors are not new. Aveox, however, has successfully broken new ground by developing a product expressly suited to the needs of the R/C modeler.

SPECIFICATIONS

Product: 1412/7 motor with speed controller
Manufacturer: Aveox Inc.
List price: $429.90 (special offer direct from Aveox through June '94—$340)
Power input: 9 to 16 cells
Max. continuous current draw: 50 amps
System weight: 15 oz. (without batteries)

Features: brushless motor technology, high efficiency and low maintenance. You install the connectors to ensure minimum wire length between the motor, the speed controller and the battery. A high-frequency speed controller is included.

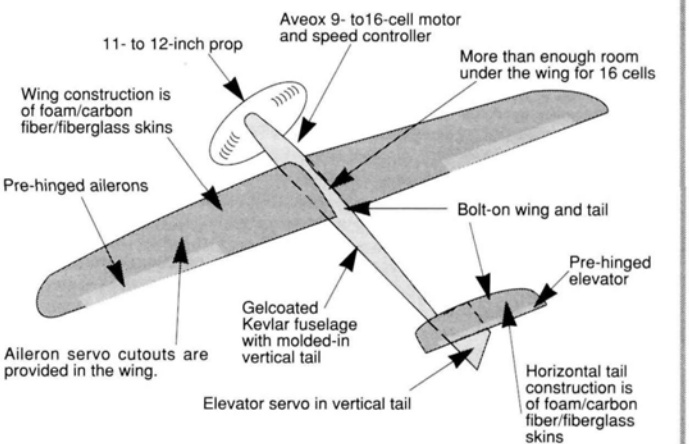
Hits
- High-quality manufacturing.
- High power output and efficiency.
- Runs equally well in either direction (no re-timing required).
- Little or no maintenance.

Misses
- Nothing to complain about!

AVEOX MODEL 1412/7 BASICS

Although the Aveox 1412/7 is listed as a 9- to 16-cell motor, based on the static thrust and current testing I have done to date (see motor performance chart), it seems most happy in the 12- to 16-cell range. The combined weight of the motor, the three-wire

Aveox 1412/7 and the Aura 2



NO PAINTING IS NECESSARY!
Flying weight is 69 ounces with 14 SR 1100s and a 270mAh receiver pack.

power connector and the five-wire speed controller is 10.4 ounces. The motor can is 2.45 inches long, 1.45 inches in diameter and sports a 1-inch-long, 5mm output shaft with a flat milled on one side. The speed controller weighs 3.5 ounces and measures 1.7x2x0.8 inches. It's a bit bulky for all but the most cavernous of fuselages.

The motor and speed controller combination is rated by the manufacturer at 50 amps continuous, but this has more to do with the dissipation of heat than possible component failure resulting from a high amp draw. The controller has two adjustment pots (high speed and low speed) so that you can set it to respond properly to your particular transmitter and receiver. These two pots are recessed into the pc board stack. You can access the unit from the side by turning the top of the pot with the side of your thumb. It's a little awkward, but this only has to be done once for each type of receiver. Red and green LEDs allow you to set the speed controller to any particular receiver without having the motor connected. The instructions are very specific in the setup procedure. Follow them to the letter, and you'll have no trouble adjusting it for throttle response that's properly matched to your transmitter throws.

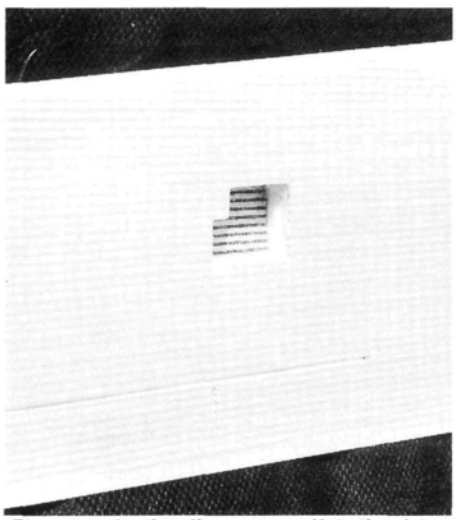
Figure 1

AVEOX MOTOR TESTING

1412/7	9-16 Cell				
Prop	**Size**	**Amps**	**Rpm**	**Thrust(oz.)**	**Type of cell**
16 CELLS					
Aeronaut	9.5x5	26	11,000	56	SR 1500
Sonic Tronics*	10x6	32.6	10,300	51	SR 1500
Aeronaut	11x6.5	35.2	9,200	62	SR 1500
Top Flite nylon	11x8	36	8,800	64	SR 1500
Graupner*	9x7	25	10,700	45	SR 1500
Zinger*	10x4	26.3	10,800	54	SR 1500
Top Flite wooden	10x4	25.3	11,000	55	SR 1500
Master Airscrew*	12x8	42	7,000	64	SR 1500
Aeronaut	11.5x7	40	9,000	69	SR 1500
Graupner	11x7	38	9,000	65	SR 1500
Graupner	12.5x6	42	7,500	74	SR 1500
14 CELLS					
Top Flite nylon	11x8	33.1	8,500	58	SR 1100
Aeronaut	14x8.5	38.3	6,500	68	SR 1100
Aeronaut	11x6.5	29.4	8,000	52	SR 1100
Master Airscrew	12x8	37	6,100	56	SR 1100
Aeronaut	11.5x7	32.3	8,200	60	SR 1100
Graupner	11x7	31.2	8,300	55	SR 1100
Graupner	12.5x6	34.5	7,300	62	SR 1100
12 CELLS					
Master Airscrew	12x8	35	6,400	53	SR 1100
Aeronaut	14x8.5	35	6,300	62	SR 1100
Aeronaut	11x6.5	26.1	7,900	44	SR 1100
Top Flite nylon	11x8	27.3	7,800	48	SR 1100
Aeronaut	11.5x7	31	8,000	56	SR 1100
Graupner	11x7	29.1	7,600	52	SR 1100
Graupner	12.5x6	31	7,000	59	SR 1100

Shorting plugs, which the modeler must place appropriately on the pc board pins, are supplied to reverse motor direction and to use the braking feature of the speed controller. (*Note: without the reversing shorting plug installed, the motor runs in the correct direction for normal tractor-type direct-drive propellers, clockwise from the cockpit.*) Aveox recommends that you do *not* use the braking function. The motor has sufficient rotational resistance not to need it. Using the brake seems to stop the motor quite violently, and damage to some airframes could result. The front case of the motor is tapped for four 4-40 screws, spaced 90 degrees apart, on a 1-inch-diameter bolt circle. I used two opposed screw holes to mount the motor on the nose of the Aura 2. Gearboxes that will fit all of the Aveox motors are in the works. Call Aveox for details.

The instructions that accompany the motor are well written and logically presented, and they even give a brief explanation of brushless motor technology. The diagrams are clear and represent the hardware exactly. No photos are presented, but none is needed.

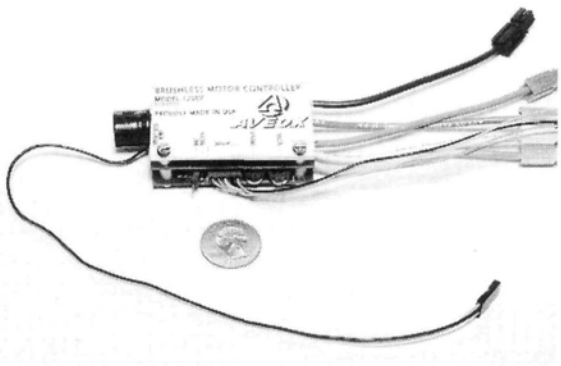


The cutout for the aileron servo. Note the slot in the aileron for the fiberglass control horn.

MOTOR TESTING

The motor was tested on my four-leg swinging-pendulum platform. You may have seen it in my article on "How to Fly Your Propeller" in the July '93 *Model Airplane News* issue. Rpm, current and thrust data were collected on this apparatus for various fixed- and folding-blade propellers at 12-, 14- and 16-cell counts. This data is presented in Figure 1. I tested various props for both sport applications (max current 25 to 30 amps) and for hot performance (max current 30 to 40 amps) for possible use in class-B electric sailplane competitions. As you can see from this table, the motor needs some pretty large props to draw any current. Rpm are understandably low with a motor of this size on direct drive, but the thrust available is very proportional and linear with input voltage. This suggests that the motor has a very wide efficiency range compared with most cobalt or ferrite brush motors. This motor acts as if it has a gearbox on it!

The other thing to note is that the amperage doesn't exponentially increase when a high voltage is applied or an oversize prop is installed. Many ferrite and cobalt motors behave linearly with respect to amps vs. thrust at various cell counts (within a very narrow range of voltage/amperage). Go outside this range by one too many cells (input power) or with a prop with too high a pitch or diameter, and watch out! The current goes sky-high without an appropriate increase in thrust (output power).

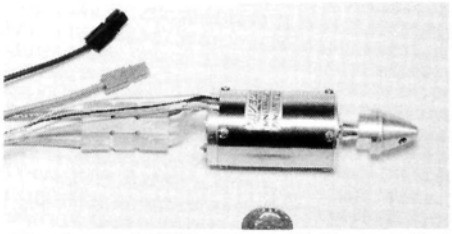


The 5- to 16-cell speed controller for all Aveox motors.

This motor, up to its rated cell count (16), doesn't exhibit this phenomenon. The largest commercially available folding propeller I tested, the Aeronaut 14x8.5, draws slightly over 40 amps and still puts out over 4.5 pounds of static thrust. Quite impressive!

I checked the linearity of the speed controller last. Stick position vs. rpm and amp draw was noted through the full range of

throttle-stick motion. I found that this controller behaves more linearly than any other high-frequency controller I have owned or tested. Every "click" on the transmitter appropriately produced a discrete and proportionate rpm increase, right up to the last "click." The brake (or complete motor shutdown without the brake function) can be set up by the low-speed pot to actuate within the throw of the throttle trim lever. This excellent throttle response is rather wasted in this



The Aveox 1412/7 motor with the supplied Graupner 5mm pinch-type prop adapter.

application (powered sailplanes), but it's a big plus for those who wish to use this motor for scale applications.

It was not my intent to do propeller testing, only motor testing. It did occur to me, however, after all the data had been collected, that there are some very good nonfolding props for those who want to use this motor in scale applications. The Top Flite* wooden props (still available) and the old, out-of-production, Top Flite nylon props performed as well as some props that were specifically designed for electric power. At lower rpm than shown in this table, most wooden props don't do as well as props that are designed for electric flight. (Another article; another time!)

In Part 2, I will cover the installation of the control and power systems in the all-composite, completely fabricated Aura 2 kit. I'll also report on the extraordinary flight performance of this airplane when it's powered by the Aveox 1412/7 brushless motor. See you then!

**Here are the addresses of the companies mentioned in this article:*

Aveox Inc., *P.O. Box 1287, Agoura Hills, CA 91376-1287.*

Model Airplane Products, *distributed by Slegers Intl., Rte. 15, Wharton, NJ 07885; (201) 366-0880.*

Top Flite Models; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826; (217) 398-3630.*

Aeronaut; *distributed by Slegers Intl.*

Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*

Sonic Tronics Inc., *7865 Mill Rd., Elkins Park, PA 19117.*

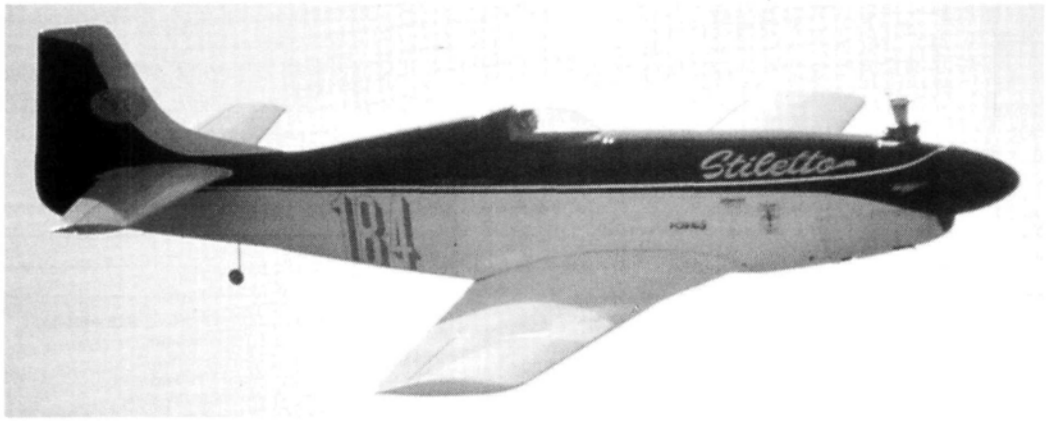
Graupner; *distributed by Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027.*

Zinger; *distributed J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.*

Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.* ■

HOW TO

Vacuum-Bagging a Foam-Core Wing



PHOTOS BY ROB WOOD

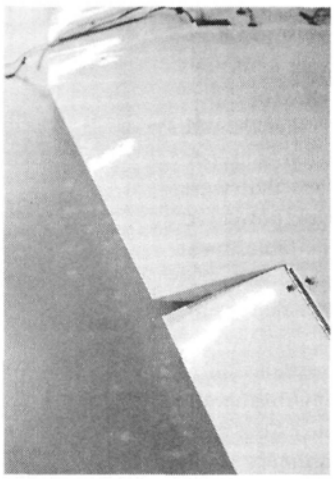
The author flew this Stiletto in the Medallion Class at the '93 Madera Unlimited Races. Its wings are of the same design as the wing shown in this article, but they were not vacuum-bagged. After repeated racing flights, the non-bagged wings have stress fractures, e.g., in the landing-gear wheel-well area. After similar treatment, the bagged version does not. Bagged wings are much stronger because the epoxy is more uniformly dispersed during the bagging process.

by ROB WOOD

BUILD STRONG, LIGHT, SPORT WINGS WITH NEAR-PERFECT AIRFOILS

GIANT-SCALE unlimited racing has developed, in two short years, into a highly competitive sport. Construction techniques that suffice for sport flying do not always produce the strength required for the high-speed, high-performance wings suitable for pylon racing.

One way to address the issue is to take advantage of construction methods developed for the world of high-performance gliders. Since their aircraft must have strong, light wings with nearly perfect airfoils, glider builders often use vacuum-bagging systems to bond wing skins to foam-cores. Vacuum-bagging provides a controllable, even pressure to every square inch of the wing's surface, thus minimizing distortion while maximizing the strength of the bond—exactly the qualities needed for high-speed racing wings. It's important to note here that, although we constructed a clipped, 22.5-percent-scale Mustang wing to develop this article, the same tools, materials and techniques can be used for any foam-core wing construction.



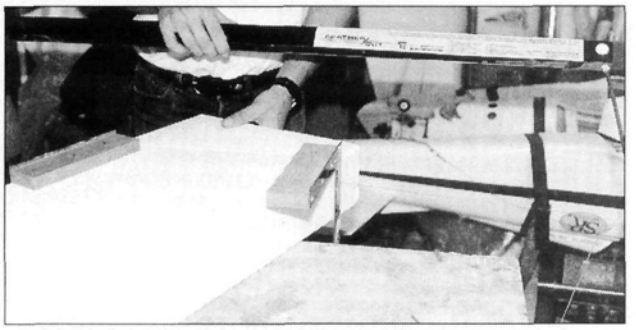
Note the precise shape of the trailing edge on this finished, bagged wing, which has Ultracote-covered balsa skins.*

The standard method of applying balsa skins to a foam-core is to spread epoxy on the underside of the balsa sheeting, position the top and bottom sheeting on the wing-core, place the assembly in the foam cradle and weight everything down until the epoxy has cured. This procedure, though simple and "low tech," has a serious drawback in that it is virtually impossible to pile enough weight on the cradle to equal the pressure obtainable with a vacuum pump. The vacuum applies equal pressure to every square inch of the sheeting—a benefit unobtainable with weights.

For this project, we decided on balsa sheeting covered with Carl Goldberg* Ultracote as our finished wing surface.

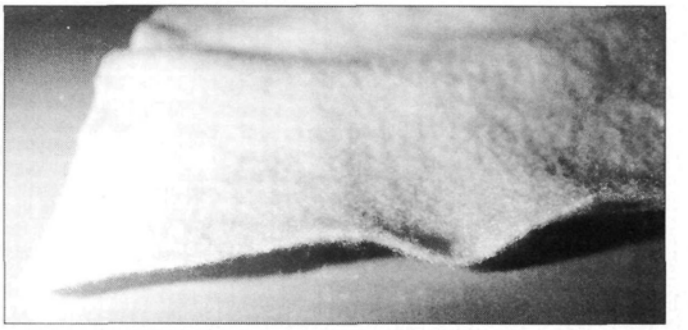
Note: the procedures outlined in this article assume the bagging of one wing half at a time. If you have two bags and two valve/hose assemblies with a "T" fitting, you can prepare two wing halves and bag them both at the same time. The manufacturer of the system recommends that you bag one half at a time until you become experienced at bagging.

These vacuum-bagging tools and materials are available from Aerospace Composites (clockwise, from rear center): Autovac vacuum pump, E-Z Lam resin, E-Z Lam hardener, E-Z Clean resin solvent, latex gloves, vinyl mixing containers, .025x36x1-inch carbon-fiber spar strips, roll of Mylar, squeegee, graduated mixing cups, SnapLink bag sealers, roll of peel-ply, roll of breather cloth, vacuum bag.



PREPARE THE FOAM-CORES

1 *After you have prepared the balsa sheeting, make all modifications to the cores as shown in the plans. If you're building a clipped wing, cut off the tips, and cut out the wheel wells, gear cavities, wiring channels, etc. Lightly sand the cores, removing any dust with a tack cloth. Important note: save the foam you cut out of the wheel and gear areas; you will need these pieces later! A Tekoa* Feathercut foam cutter is used here.*



PREPARE THE BREATHER CLOTH

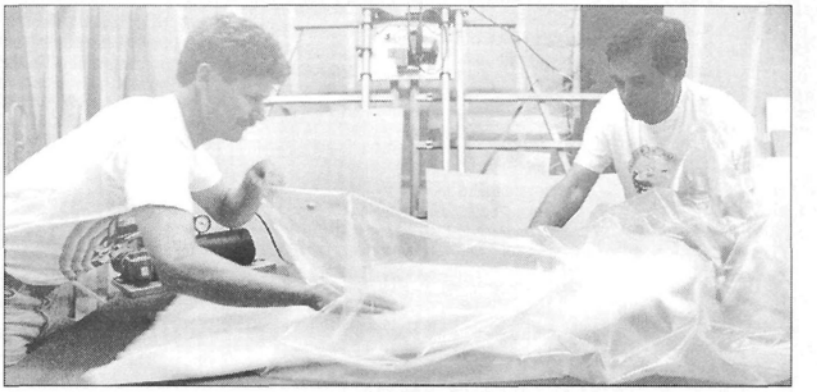
2 *The breather cloth is a piece of polyester felt that's used as a bed for the wing assembly; it prevents the bag from collapsing around the valve before all the air has been pumped out. Cut the cloth 18 inches longer and a few inches wider than the wing assembly.*

• MATERIALS
2 lb.-density white-foam wing-cores
3/32 in. balsa skins, 1/2 in. longer and wider than the cores
25-mil, 1x36 in. carbon-fiber strips
0.5 oz. carbon-fiber matting (optional for increased rigidity)
E-Z Lam epoxy resin and 30-minute hardener

Painted wing option
1/2 oz. glass cloth
Soft camel's hair brush
91% pure isopropyl alcohol

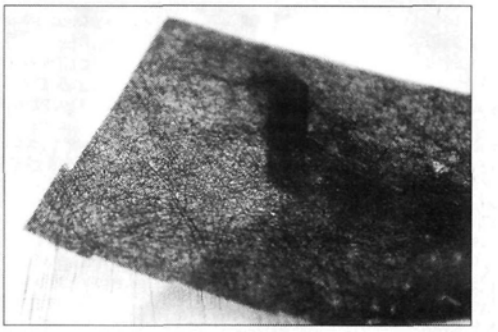
• TOOLS
Autovac vacuum pump and hose
Vacuum bag (2-mil nylon film, reusable)
Two Quicklock bag seals
Breather cloth (non-woven polyester "felt")
Measuring/mixing containers
Mixing sticks
Epoxy squeegee
"Acid" brushes
Latex gloves
Tack cloth
Glass-cloth cutter, or razor knife
E-Z Clean hand/tool cleaner
Denatured alcohol
Saran Wrap
Butcher paper or plastic drop cloth
Sandpaper, various grits
Masking tape
Clean rags
Electric blanket or heat lamps (optional)

• ENVIRONMENT
Well-ventilated room, 70° to 80° F
Canister mask
Flat work surface



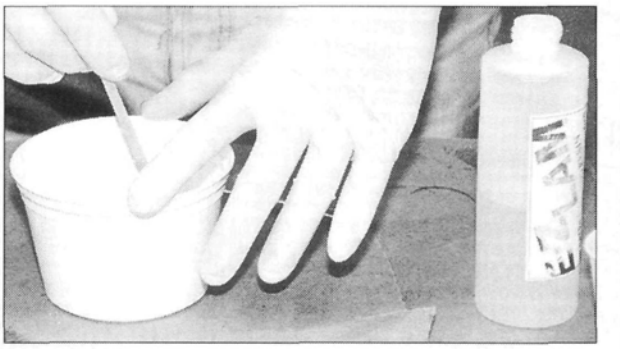
PREPARE THE BAG

3 *A tube of 2-mil nylon, available in 18-inch and 36-inch widths, becomes a bag when sealed at both ends. The tube must be wide enough to surround the wing assembly and long enough to extend 24 inches past the ends of the wing core. Following the directions included with the system, install the vacuum valve at one end of the tube, and put the breather cloth into the bag. Make sure one end of the breather cloth is positioned under the valve!*



PREPARE THE 0.5-OUNCE CARBON-FIBER MATTING

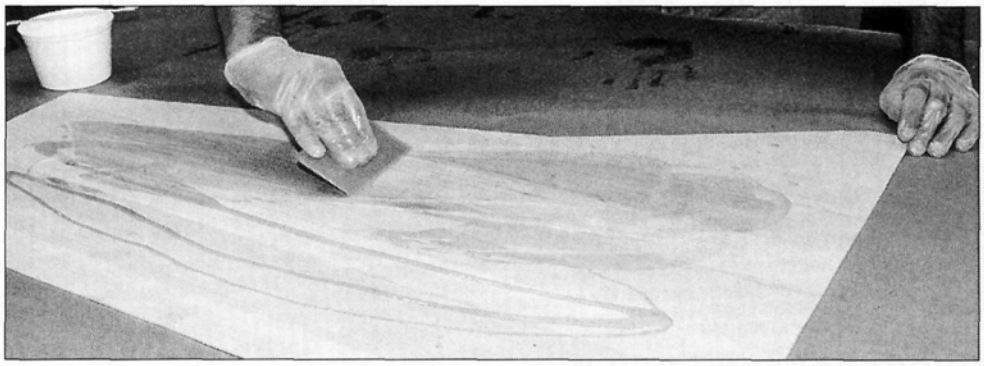
4 *Using the prepared balsa skins as templates, cut the matting to the same shape and size with the cloth cutter or razor knife. Make four identical pieces. The matting can be cut easily with scissors or a mat knife and is used to reinforce the balsa wing sheeting.*



MIX THE EPOXY

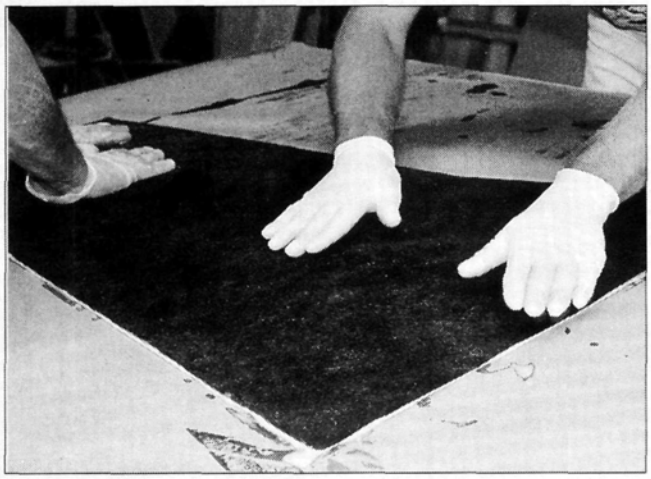
5 *Caution: wear gloves, and use a mask appropriate for toxic materials! Even though Aerospace Composites* E-Z Lam epoxy is fairly-user friendly, repeated exposure can cause you to become "sensitized" to it, and you will not be able to use it or any other brand of epoxy without suffering a skin reaction and/or breathing problems.*

Mix 3 ounces of the epoxy according to the manufacturer's directions. Mix the epoxy exactly to proportion, stirring thoroughly for one minute. If you use carbon-fiber matting, this is enough for one skin. If you opt not to use carbon-fiber matting, mix 1.5 ounces of epoxy instead.



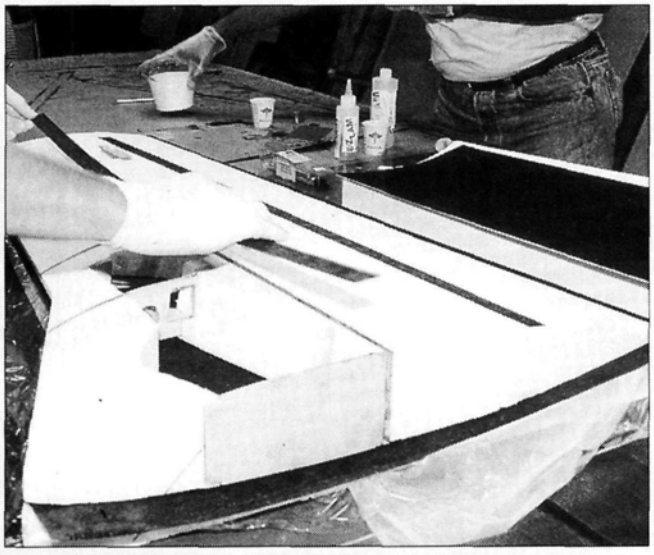
WET OUT THE TOP BALSA SKIN

6 *Use the squeegee to apply an even coat of epoxy to the skin. If you plan to use carbon-fiber matting, wet out the top balsa skin with a generous coat of epoxy; if using only balsa, apply a "dry" coat. In other words, if you opt not to use matting, squeegee the skin almost dry. If using the matting, leave the balsa surface fairly "wet."*



APPLY THE CARBON-FIBER MATTING TO THE BALSA SKINS

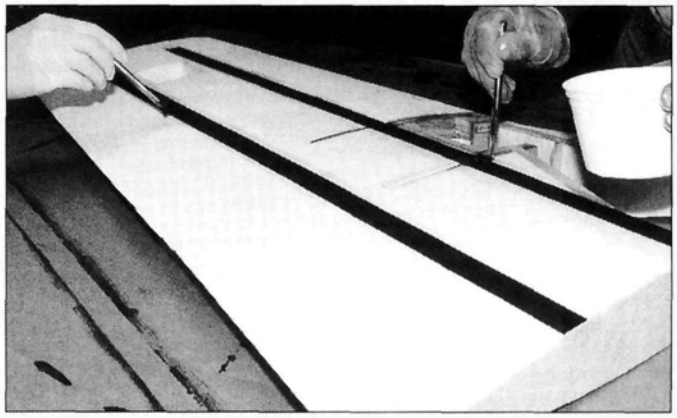
7 *Lay the matting on the wing skin. Simply pat the matting with your gloved hands until its surface is wet with epoxy. (Don't use the squeegee on the matting.) E-Z Lam has a low viscosity and soaks through easily. When the matting is wet, repeat steps 4 through 6 for the bottom skin and set both aside.*



PREPARE THE TOP SURFACE OF THE CORE

9 *Follow the procedures for installing spar caps and strips outlined in step 8. Apply extra epoxy around the wheel wells. Remember the note in step 1 concerning the foam pieces cut out of the wheel-well areas? Wrap the pieces in Saran Wrap and put them back into their cavities. This will prevent the vacuum from crushing the balsa skin over the wells.*

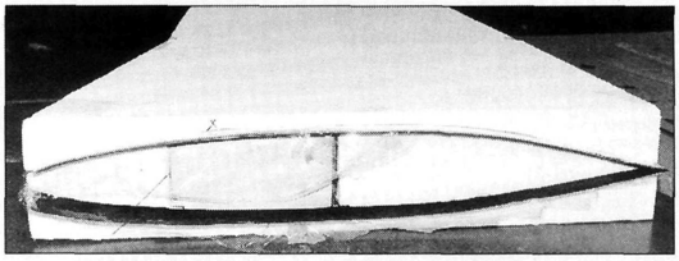
Lay the prepared top wing skin on the foam-core, position it so that it's aligned with the bottom sheeting, and press firmly.



APPLY CARBON-FIBER SPAR CAPS AND SPAR STRIPS TO THE BOTTOM CORE SURFACE

8 *Line the bottom cradle with Saran Wrap, and lay the prepared balsa/carbon-fiber skins in the cradle, wet side up. Four 1x36-inch carbon-fiber strips will be applied to the cores as spar caps and as surface spars. We routed out 1-inch-wide grooves where we planned to install the strips, and if you have access to a router, you might want to do the same. If you don't have a router, the strips may not make a noticeable "bump" under the skins (although we haven't tried it).*

Wet out the bottom surface of the foam-core wing half in the areas where the strips will be applied, and wet out one side of each strip. Use just enough epoxy to wet out the pieces. Position the strips in place on the core, and press them into the epoxy. Using the acid brush, apply a thin coat of epoxy to the exposed surfaces of the strips. The bottom wing half's surface is now ready to be joined to the prepared skin. Position the core on the skin so that the skin overlaps the core approximately ¼ inch all the way around.

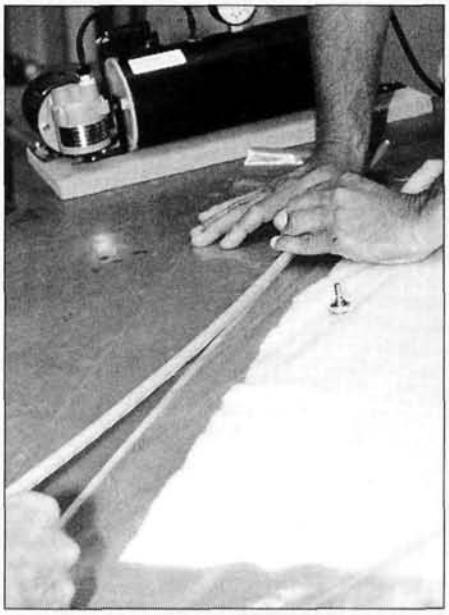


POSITION THE UPPER CRADLE ON THE FINISHED ASSEMBLY

10 *In order, the layers are: bottom foam cradle, Saran Wrap, balsa sheeting, carbon-fiber matting, bottom wing-core surface with carbon-fiber strips installed, top wing-core surface with spar strips installed, carbon-fiber matting and top balsa sheeting. If these layers are correct, cover the top balsa skin with Saran Wrap.*

Lay the upper foam cradle on the top surface of the wing, and carefully align the upper cradle with the bottom cradle. Tape the cradles together to ensure alignment.

Note: at this point, it is a good idea to wet out a small piece of 3/32-inch balsa, apply it to a piece of foam, weight it down and set it aside. This is a test piece that you will use to determine when the epoxy has cured. This is also a good time to set up a heating arrangement, if desired. E-Z Lam 30-minute epoxy cures in 24 to 48 hours at 70 to 80 degrees F. The process can be speeded up by increasing the ambient air temperature around the bag, either by placing the bag on an electric blanket, or by positioning heat lamps over the assembly.

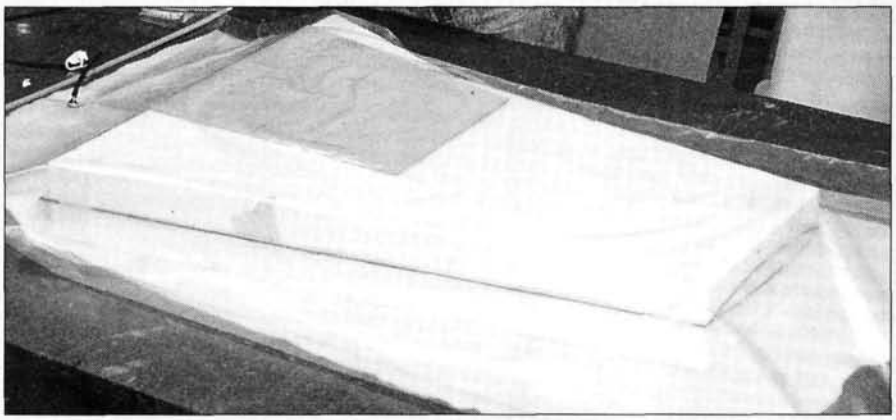


INSERT THE WING ASSEMBLY INTO THE BAG, AND SEAL

11 *The traditional method of sealing vacuum bags is to use a very thick, double-sided tape. This tape is prone to leaking and ruins the ends of the bag where it is applied. Aerospace Composites has come up with a great alternative with their Quicklock seals. These seals consist of a plastic "C-channel" strip that is longer than the width of the bag, and a nylon rod that snaps into it.*

The Quicklock is easy to use and allows the bag to be reused indefinitely. Position the nylon rod across and under one end of the bag, making sure you clear the breather cloth. Lay the C-channel on top of the bag, lined up with the rod, and start to snap the rod into it, trapping the bag material between the rod and the channel. It's best to start at one end and work to the other, pressing down firmly with the palm of your hand. Expect resistance the first time you use a Quicklock, as they're somewhat stiff when new.

Flip the end of the bag over, and visually confirm that the rod is firmly and completely seated in the channel. Repeat the procedure, and seal the other end of the bag.



EVACUATE THE AIR IN THE BAG

12 *The Autovac automatic vacuum pump maintains the vacuum in the bag at a preset level. Vacuum is measured in inches of mercury, with a maximum of 18 inches for blue foam. Never use more than 8 inches of mercury with light-density (white) foam. Follow the directions that are included with the pump, and set the vacuum accordingly.*

Connect the vacuum hose to the valve in the bag, and turn the pump on. As the bag begins to collapse, smooth any wrinkles that form in it, and pleat it at the corners of the foam cradles. Pleating the material prevents the bag from crushing the corners of the assembly.

The pump will automatically shut off at the preset level of vacuum and will turn itself back on when the vacuum falls 2 inches below that level. As more and more of the air is evacuated, the pump comes on less frequently, and for shorter periods.

Check your test piece in 24 hours, and if it has cured, unplug the pump, disconnect the vacuum hose and unseal the bag. Remove the assembly from the bag, remove the tape holding the cradles together, and separate the cradles from the wing half.

Repeat the entire procedure for the second wing half, trim off the excess balsa, attach the leading edges and wingtips, shape and sand. Join the wing halves with epoxy, and glass the center section using 6-ounce cloth and epoxy. Cut out the wheel wells and gear doors, and remove the foam plugs. Finish-sand with 320-grit. The wing is now complete and ready for covering.

Vacuum-bagging is definitely superior to any other method of applying balsa skins to foam-cores. To equal the clamping force of the 8 inches of mercury that's available with the vacuum pump, you would have to pile 1,500 pounds of weight on top of your foam cradles. The vacuum creates an even pressure throughout the assembly and forces excess epoxy out of the laminations to the outside of the assembly where it can be removed. This process results in the lightest, strongest wing possible—the ultimate in an unlimited racer or a Sunday fun flier.

**Here are the addresses of the companies mentioned in this article:*

Aerospace Composite Products, *14210 Doolittle Dr., San Leandro, CA 94577.*

Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*

Ultracote; *distributed by Carl Goldberg Models (address above).*

Tekoa, *3219 Canyon Dr., Hollywood, CA 90068.* ■

'93 Scale Mast

Sw

OCTOBER 21 to 24; Fountain Valley, CA; Mile Square Park; superb weather; 44 of the best builders/fliers around. These were the ingredients for the 14th Annual Scale Masters Championships, and the '93 edition just may have been the best one yet.

PHOTOS BY RICH UKAVITCH

Unusual British Fleet Air Arm markings were chosen by Nick Ziroli Jr. for his big Hellcat built from his dad's plans. Nice change from the more frequently seen blue U.S. Navy scheme. 5.2 Sachs-Dolmar power, 49 lbs.

To qualify for the Championships, modelers had to place high at one of the regional qualifiers held around the country. The fact that three of my fellow club members (we belong to the Long Island Skyhawks) traveled across the country to compete gives you an idea of just how prestigious an event this has become. Tom Polapink, Nick Ziroli Jr. and Nick Tusa all ventured westward.

Harris Lee started the Championships years ago, and he has continued to be its prime mover. Rather than give it up because of a generally tough economy in which many of the sponsors/supporters had to withdraw, Harris frequently underwrote the event personally, and sometimes he had to absorb the losses. If you ever have the opportunity to meet this great guy, just tell him thanks, as that seems to be all the appreciation he'll accept for his efforts.

Tough economic times weren't enough to stop Pacer Technology from continuing its support of this event. They've been there since the early days. Very few events occur without sponsorship. Local clubs often ask manufacturers and local hobby shops to donate prizes for club fun flys! Without support like this, we'd have no events or competition!

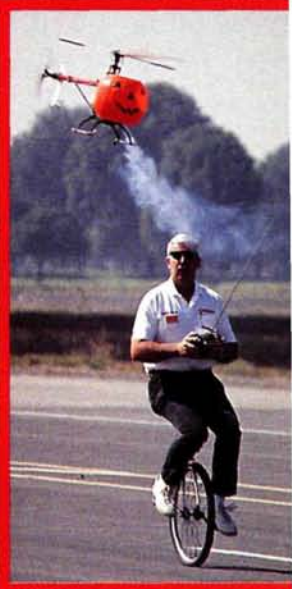
(Continued on page 75)

b models and fair winds—the best yet!

evs

by RICH URAVITCH

Video entrepeneur and perennial competitor Dick Hansen campaigned his Albatross DVa, which is the prototype for the Proctor kit. Popular subject; three competed at this event.



■ *Right, top to bottom: Shailesh Patel comes in one wing low with his Yellow Aircraft F-14A Tomcat. 96.5 Static score.*

■ *Dave Sawatzky's beautiful D.H. Twin Otter seconds before impact. Lost an engine on downwind, spun in.*

■ *Midday demonstration included a great show by Dan Egelhof, working from a unique position, flying Mr. Pumpkin. Performance informatively narrated by Dan's young son, Matt.*

■ *Mr. and Mrs. Terry Nitsch; Terry and Sheila with their second-place winning BVM F-86 Sabre that also placed second at Top Gun '93 and first at 1993 Nationals. Beautiful model!*

■ *Doug Crumley sure seems to like the "L-Birds"; this Stinson L-5 is his follow up to his L-19 Bird Dog. Modified from Vaillancourt plans, the Stinson is Enya VT240 powered and weighs 28 lbs.*

How many Zirolis does it take to launch Tom Polapink's Sopwith Snipe? Apparently just two: Sr. at the rear end and Jr. at the front end. Tom is talking to the Quadra 35!

The winner, his support team and his gorgeous airplane. Dennis and Linda Crooks and the Lear 35A. It weighed 27 pounds with two O.S. .77s.

EVENT OPENERS

The event officially opened on Thursday with Static Judging that continued into Friday and included the first of five scheduled rounds of flying. You might think that the first round of any contest would be a warm-up for most of the contestants and that they wouldn't worry about the score because the best three of five would be averaged. That is an incorrect assumption because you never know which flight will be your best. For example, second-place winner Terry Nitsch carded his best flight score (a 95.0!) on the first flight. So did Gene Job with a 91.25. The high flight score of the meet was Dennis Crooks' second round of 97.50 while the top Static of 96.5 was a three-way tie between Crooks, Nitsch and Patel. Proving that you're never out of the running, past Masters winner and co-CD for this event, Diego Lopez, had low throwaway scores for rounds 1 and 2, and he came back to end up in fifth place. He scored no less than 89 on rounds 3, 4 and 5. I think there's a consistency message in there somewhere!

Round two was flown Saturday morning, and it was evident that the flying was improving. Dennis Crooks flew his best flight and posted the highest flight score of the meet—an incredible 97.50! As is usually the case, after only two rounds, no clear leaders were evident; it was evident that this was going to be a hotly contested event. To relieve the pressure and give everyone a break, a lunchtime display showcased some fantastic flying demos and a variety of creative "techno-goodies" that were available to the R/C'ers. There was some pretty impressive flying: Andreas Gietz with his big, Seidel-powered Yak-11; Jerry Kitchen's always impressive flying with his Extra 300; the Aeroloft "T-Bird 5" ducted-fan speedster whose "airborne pilot" (Steve Schlachta's voice) announced his maneuvers to the crowd over the PA; and the real crowd-pleaser—Dan Egelhof and his "Mr. Pumpkin" heli that he flew while riding a unicycle!

The True Jet turbine-powered Viper, skillfully flown by Kent Nogy, caught the attention of hundreds of spectators. Another equally sophisticated powerplant was

Here they are, folks—your 1993 Scale Masters Championship Winners!

A not-too-often-modeled subject—the Curtiss SB2C Helldiver—built and flown by Bob Olson. Bob had a problem with the retracts on this flight but a skillful one-wheeled landing kept damage to a minimum.

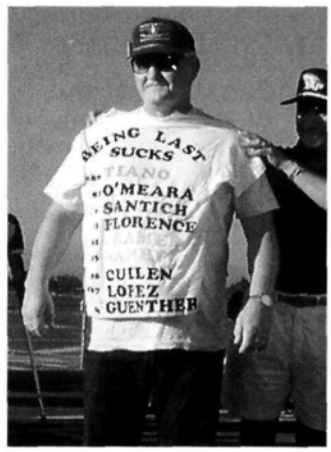
TOP 10 FINISHERS, 1993 SCALE MASTERS CHAMPIONSHIPS

FLIER	AIRPLANE	STATIC	TOTAL	PLACE
Dennis Crooks	Lear 35A	96.50	190.750	1
Terry Nitsch	F-86	96.50	188.750	2
Gene Barton	A-1H Skyraider	95.00	187.917	3
Shailesh Patel	F-14A Tomcat	96.50	187.833	4
Diego Lopez	A-1H Skyraider	95.00	186.417	5
Tom Polapink	Sopwith Snipe	96.00	183.730	6
Jeff Foley	A6M3 Zero	94.50	183.500	7
Lee Rice	F-104	93.50	182.500	8
Gene Job	A6M5 Zero	92.00	182.083	9
Charlie Nelson	VKS-7F Waco	94.50	181.167	10

SPECIAL AWARDS

AWARD	RECIPIENT	SPONSOR
Pilots' Choice	Dennis Crooks	Scale Masters Program
Best Military	Tom Polapink	Orange Coast R/C Club
Best Civilian	Dennis Crooks	Orange Coast R/C Club
Best Graphics/Markings	Terry Nitsch	Aeroloft Designs
Best Scratch-built	Tom Polapink	Scale Squadron
Best Kit Built	Shailesh Patel	Scale Masters Program
Grey Eagle	Chuck Fuller	Scale Masters Program
Craftsmanship	Jeff Foley Dennis Crooks Terry Nitsch	Dry-Set Markings
Scale Achievement	Jeff Foley	Scale Model Research

Award certificates were also presented by Glennis Aircraft.



The infamous garment—won this year by Bob Roselof. Should we do a "Where are they now?" for the previous recipients?

Chino airport—a scale modeler's mecca?

Where do scale modelers get their inspiration, and more important, their documentation for the outstanding models at events like the Scale Masters and Top Gun? Well, to be sure, magazines and other print media provide a lot of the material, but nothing beats photographing the full-scale airplane. Airports and museums are great spots for this, and Chino, CA, is, perhaps, one of the best because it has both.

Always working, Bob Banka of Scale Model Research caught shooting Don Lee's Twin Beech for another Color Foto Paak.

In conjunction with this year's Scale Masters Championships Event, a trip to the Chino airport was arranged by Scale Masters' founder Harris Lee for contest participants, their families and friends. These lucky folks were taken to an area between two strips of hangars only to find further progress impeded by a glistening P-51D Mustang and a F4U Corsair! Darn! Walking around these two magnificent planes to get to the flight line, the wide-eyed attendees found two Staggerwing Beechs, two PT-17 Stearmans, a twin Beech D-18, a BT-13 Vibrator, a Waco UPF-7, a D.H. Vampire and a Moraine Saulnier Paris jet!

One of the two beautiful Beech Staggerwings that Don Lee had on display for modelers to appreciate. Other airplanes included PT-17s, a Beech D18, a Waco, a T-6, a Mustang, a Corsair and a Vampire!

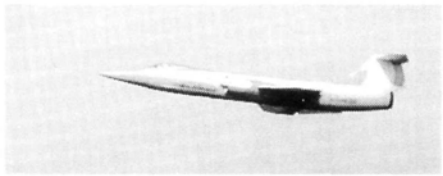
So, how did all this stuff get there, and who does it belong to, you ask? Well, our benevolent host was Don Lee, Harris's brother, who opened up one of his hangars, converted it to a restaurant, and fed and "watered" everyone. In addition to calling a small number of his airplane/owner friends together, he offered rides in his Staggerwing. I didn't get to eat much because I was getting a T-6 aerobatic hop! Nick Ziroli Sr. and Jr. received similar rides, and they're still talking about it!

Back down on the ground, I was told that part of the festivities included a visit to The Planes of Fame Museum, which is located within walking distance of our eatery. I guess the museum staff had already been briefed that we were airplane "nuts," and they seemed to be much more tolerant than I would have been if those were *my* airplanes in the museum! Museum staffer Steve Moriarty was a walking aero encyclopedia, and he provided some background on the museum's aircraft. He also pointed out little-known details that only other scale modelers would appreciate. Photo opportunities abounded, and the documentation files of many modelers grew significantly after this outing. I know mine sure did! It just doesn't get any better than this!

Those of you who are familiar with the "First Flights" series presented on the "Arts and Entertainment" TV network may not be aware that many of the aircraft that are covered in each episode are based at Chino and that much of the videotaping took place there as well. Probably more fighters are rebuilt at Chino than any other place in the world. Mustangs, Sea Furys, Spitfires, Tigercats, F-86s and A-4 Skyhawks are considered almost routine residents of this haven. A lot of the Reno racers live or have lived here also, e.g., the Red Baron, the Dreadnought, the Super Corsair and the Dago Red. Rare birds like the Douglas A5D Skyshark and a FICON Republic RF-84F are also here.

This place is a "must see" for anyone who is interested in airplanes. This is the place for modelers who think that they've exhausted all sources of documentation for that model they're building. What you already have on hand is probably just the tip of the iceberg; Chino provides the ocean it's floating in!

Ed Newman (l.) lends a hand to Lee Rice getting the Red Baron F-104 ready for another round. No photo distortion here; that wingspan really is only 35 inches!



Putting to rest, once and for all, the speculation that a scale F-104 model can't fly, was this beautiful Starfighter entered by Lee Rice. Fast and very groovy; 8th place overall.

the Robart R-780 radial that resided in the nose of Dennis Crooks' T-6. Both of these are production engines, and neither should cause its purchaser to want more power!

BREAKTHROUGHS

Bill and Walt Newman introduced an onboard telemetry system that should relegate the timing devices (like radar guns) to the same archives in which we find reed radio systems and thread hinges. This system has an audio downlink that tells you in a soothing female voice the plane's speed, the altitude and the engine's rpm. No more of the "My jet was going 275mph when that engine unloaded to 35K in a dive!" It either was or it wasn't, and this system tells the true story! No doubt, additional data channels and sensors could be incorporated to provide other information.

Equally unique was the autopilot/gyro (no, it's not an aviation-oriented Greek sandwich!) shown by Ziv Nave. Installed in his Ultimate bipe, it made the model recover to a stable attitude, regardless of what attitude it was in when Ziv shut the transmitter off! All of this great equipment makes one wonder what the next breakthrough in R/C will be! The crowd and all the participants sure got a huge dose of entertainment at this lunch-time show!

After round three was completed on Saturday, it looked as if Dennis Crooks would be the guy to beat. Everyone was bunched up behind him, and the pressure was beginning to mount.

The pit area was alive with activity generated by the contestants and their crews. Spectators were provided an almost unobstructed view of the activity from behind a security fence.

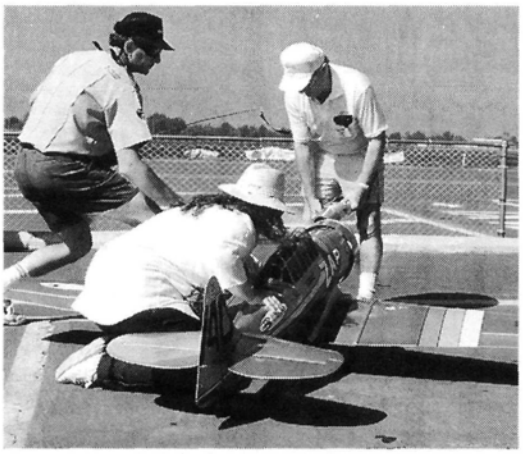
Nick Tusa's giant, and I mean giant, Fokker D-VII is ⅓ scale, which translates into a 10-foot span. A Quadra 100 supplies the urge while the huge wing area has no trouble lifting the 40-pound weight.

The timing of the Awards Banquet couldn't have been better. It gave everyone the opportunity to forget about the competition, socialize, discuss new projects and have a great time. If everyone who claimed to have a new airplane under construction finishes it, you're going to see even more spectacular entries at future competitions. Bear in mind, however, that the projects mentioned became more and more involved as the evening wore on, and "refreshments" tended to dilute, among other things, reality! I left when the discussion centered on which subject might have the competitive edge: a B-52 powered by eight turbines or a team entry consisting of an A-10 and a KC-135 tanker doing an in-flight refueling hook-up as an optional maneuver! And the guys involved in the discussion were among those who were going to fly the next morning!

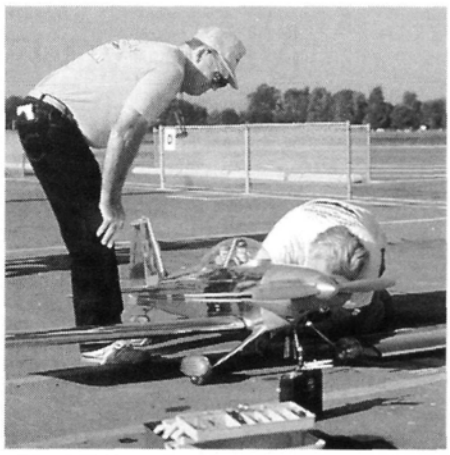
AND THE WINNER IS...

On Sunday, the weather was beautiful, especially to us Easterners who would likely experience a 30-degree temperature drop by the next day. The fifth and final round was flown, and the scores were tabulated. Dennis Crooks emerged as the '93 Scale Masters Champion followed by Terry Nitsch. Two full points separated them but, from there down, it was really tight; a mere 84 thousandth of a point separated third-place Gene Barton from "clean-up" finisher Shailesh Patel, who posted less than a third of a point edge over Diego Lopez! Remember, all of this is after some really tough static judging and flying five rounds. If you win here, you deserve it, and Dennis sure does. He flew his immaculate Lear flawlessly, even after taking time off from the Scale Masters competition for a while.

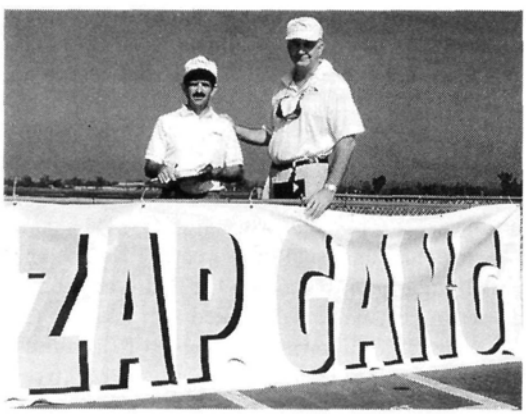
Everyone who attended this year's event, whether they were modelers or not, came away entertained. Some of us came away enlightened and excited—enlightened by what's going on in scale and excited by the prospects of next year being even better. If you get a chance to attend, don't miss it; you won't regret it! ■



Bob Walker of Robart gets ready to put the starter to the big, powerful R-780 radial, filling the cowl of Dennis Crooks' T-6 demo airplane. Linda Crooks provides much needed restraining help!



Chuck Fuller—the Grey Eagle—believes in being prepared. Seen here performing minor maintenance on his new Byron RV-4. Chuck is a master at replicating natural metal finishes.



Two of the many guys who "made it happen": co-C.D. Diego Lopez (l) and Pacer's Herschel Worthy. Event's success due, in great measure, to industry sponsorship, the lion's share of which came from Pacer.

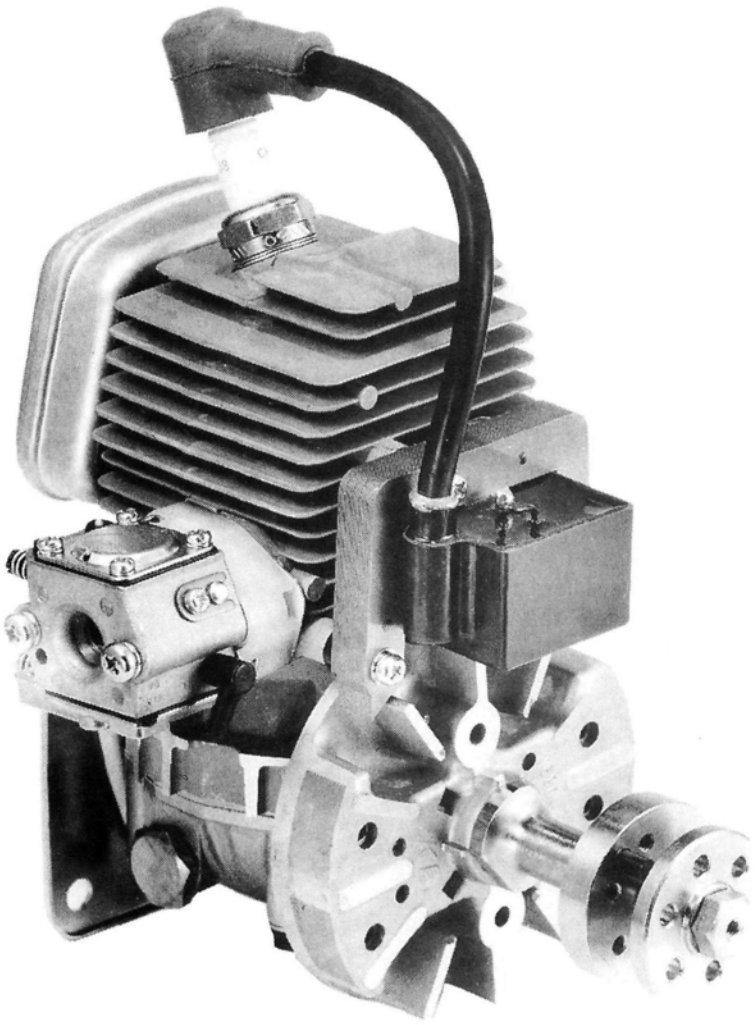
The Vultee BT-13 (Navy SNV) was built by Larry Sutherland from the Bert Baker kit. Skillfully understated, it got better the closer you looked. Static judges thought so too; they gave it a 93.

ENGINE REVIEW

Zenoah Quartz G-38

Massive reliability and economic operation

by MIKE BILLINTON



The Zenoah Quartz G-38 is a solid, chunky-looking machine and a reliable, practical powerplant for large-scale aircraft.

KOMATSU ZENOAH Co. of Tokyo, Japan, manufactures three industrial petrol 2-stroke engines that form the basis of the model-engine conversions marketed by its U.S. distributor—ISC Intl.*, based in Indianapolis, IN. They are the Quartz G-23cc, which has a rear-mounted flywheel magneto; the Quartz G-38cc with a front-mounted flywheel magneto; and the largest—the Quartz G-62cc, which also has a front-mounted magneto.

PHOTOS BY MIKE BILLINTON

The solid twin-web crank assembly holds center stage in this photo and in dynamic importance. Rubber seals are fitted at each end of the assembly.

These modified engines have been made mainly for use in a variety of large-scale model aircraft, and the emphasis is very much on solid, smooth, easy performance at rpm that are quite low compared with normal model practice.

The manufacturer's quoted performance figures are:

G-23cc—1.6hp at 9,500rpm (16x8 prop);

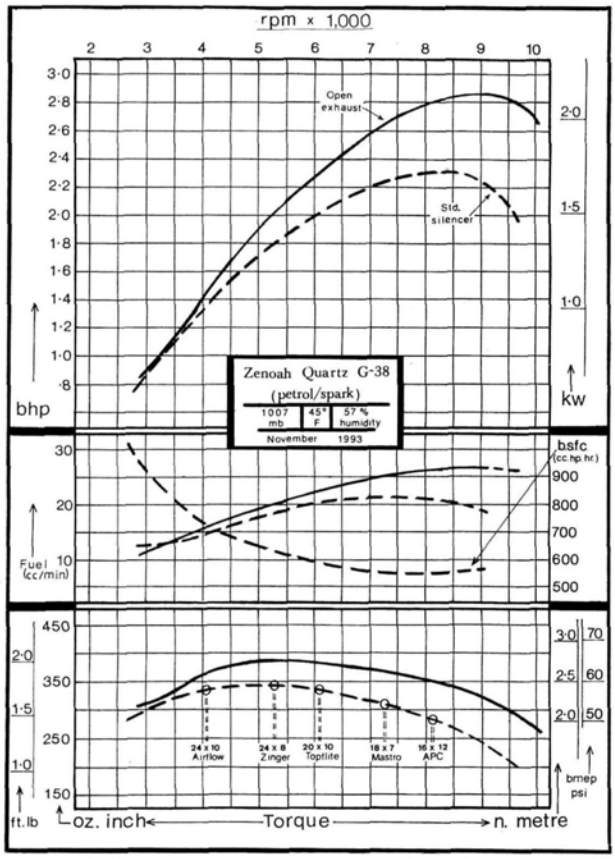
G-38cc—2.2hp at 7,000rpm (20x8 prop);

G-62cc—4.7hp at 7,000rpm (22x8 prop).

Tests suggest that these figures do not emphasize the capabilities of the three engines to also perform very strongly further down the rpm band—to the quieter, even more serene area around 5,000rpm.

As with several other large, single-cylinder engines for model use, there is an associated reluctance to travel much faster than the maximum hp; for example, 8,000rpm on the G-38 tested here is a satisfactory maximum.

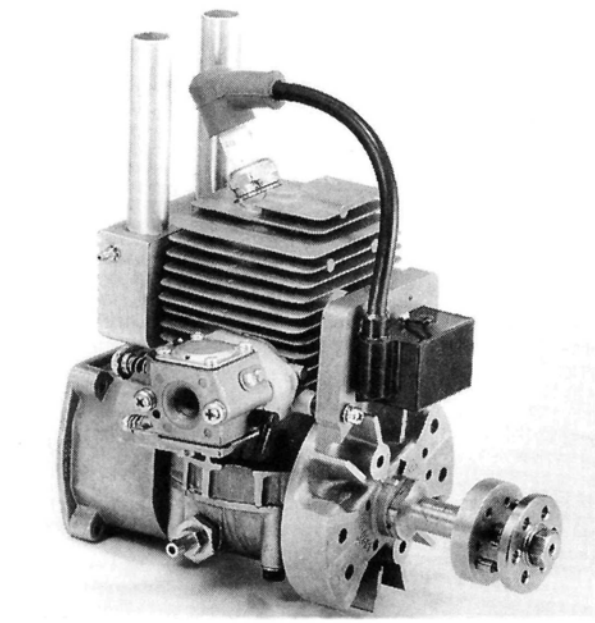
To some extent, this limitation is unimportant, given the usual heavy-duty usage; it looks as if its long overhang (from prop to radial mount), in combination with strong single-cylinder pulses, places more restraint on what's possible with an engine this size than if these same engines had the usual model engine side-beam mounts. However, with good prop balancing (in both horizontal and vertical planes) and robust bulkheads linked securely in the fuselage, the G-38 will operate satisfactorily up to around 8,000rpm. Thereafter, balancing accuracy and mount security become more demanding.



MECHANICAL POINTS

The now-familiar split crankcase is used because it doesn't have a detachable cylinder head, and this makes the casting process for the cylinder-head shape, the cylinder bore and the transfer ports, and the final chroming of the one-piece aluminum upper block more feasible. In addition, installation of the twin-web crankshaft in the main cylinder block from underneath also becomes practicable. The "bottom end" then becomes effectively just a large main bearing cap.

The G-38 uses substantial single-row ball bearings that are seen in some other engines and is probably the better for it, particularly where higher rpm are sought. Caged needle bearings are used in each end of the hardened-steel connecting rod. A large, 12mm-diameter crankpin is firmly pressed into each crankweb to provide secure, accurate alignment. In the unlikely event of damage, the whole crank/rod assembly is a factory



A Walbro carburetor fitted with alloy main fuel needle extension for easy finger operation on dynamometer. A crankshaft steel propeller driver is screwed onto the front and uses a steel washer and bolt.

SPECIFICATIONS

Zenoah Quartz G-38

WEIGHTS & DIMENSIONS

Capacity	2.288ci (37.49cc)
Bore	1.497 in. (38.02mm)
Stroke	1.300 in. (33.02mm)
Stroke/bore ratio	0.868:1
Timing periods	Exhaust—158° Transfers—114° Sub-piston induction—Opens 114° ABDC Closes 66° ATDC Total period 132° Blowdown 22°
Combustion volume	4.6cc
Compression ratios	Geometric 9.15:1 Effective 6.34:1
Exhaust-port height	0.448 in. (11.4mm)
Cylinder-head squish	0.040 in. (at closest piston-to-head clearance)
Cylinder-head squish angle	Trumpet shape
Carburetor bore	0.438 in. (11.13mm)
Crankshaft diameter	0.472 in. (12mm)
Crankpin diameter	0.472 in. (12mm)
Crankshaft nose thread	0.310 in.x26 TPI (nearest 8x1mm)
Wristpin diameter	0.354 in. (9mm)
Connecting-rod centers	2.40 in. (61mm)
Engine height	6.3 in. (160mm; cylinder head to bottom flywheel)
Width	4.75 in. (121mm; carb face to flywheel o.d.)
Length	5.5 in. (140mm; prop driver/rear of radial mount)
Ex. manifold bolt spacing	1.4 in. (35.6mm)
Frontal area	19.1 sq. in.
Weight	Bare—4 lb., 2 oz. (1,871g) with standard silencer—4 lb., 6 oz. (1,984g)
Crankshaft weight	10.3 oz. (294g)
Piston weight	2.3 oz. (66g)

Performance:

Max. b.hp	2.86 @ 9,055rpm (open exhaust/petrol) 2.31 @ 8,493rpm (standard silencer/petrol)
Max. torque	300 oz.-in. @ 5,220rpm (open exhaust) 346 oz.-in. @ 5,040rpm (standard silencer)

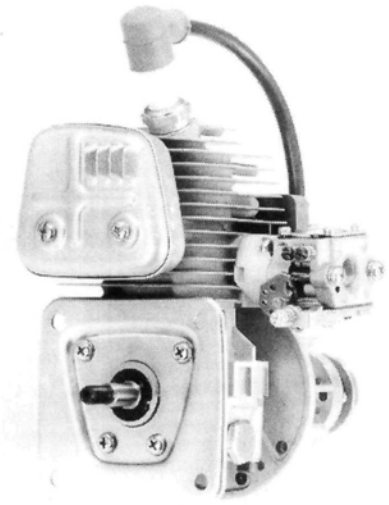
Propeller rpm	**Open exhaust**	**Std. silencer**
24x12 Airflow	4,061	3,880
24x10 Airflow	4,340	4,008
24x8 Zinger	5,723	5,263
20x10 Mastro	5,766	5,450
20x10 Top Flite	6,344	6,040
18x7 Mastro	7,704	7,261
20x6 Zinger	8,012	7,485
18x8 Top Flite	8,034	7,597
16x12 APC	8,565	8,126
16x6 Merati	9,450	8,800

Performance equivalents

b.hp/ci	1.250	1.000
b.hp/cc	0.076	0.062
b.hp/lb.	0.690	0.528
b.hp/kilo	1.530	1.160
oz.-in./ci	166.100	151.200
oz.-in./cc	10.100	9.230
oz.-in./lb.	92.100	79.100
Newton meter/cc	0.072	0.066
b.hp/sq. in. frontal area	0.149	0.121

Manufacturer: Komatsu Zenoah Co., 142-1 Sakuragaoka-2 Higashiyamato, Tokyo, 189 Japan.
USA distributor: ISC Intl., P.O. Box 40116, Indianapolis, IN 46240.

replacement part. Looking up into the cylinder block from below, you can see that the bifurcated transfer passages have been rotated around the cylinder axis some 20 degrees—apparently to allow a less restricted position for the sub-piston induction port in the cylinder. This symmetrically timed inlet is simple and extremely reliable, though it inevitably results in lesser breathing capacity than the more expensive asymmetric timing methods, i.e., reed valve, rotary crankshaft, drum, or disk. For its designed "industrial" duty, its reliability is hard to beat.



Here, you can see the sub-piston induction position of the carburetor. A heat-resistant plastic spacer is used to separate the carburetor from the hot cylinder.

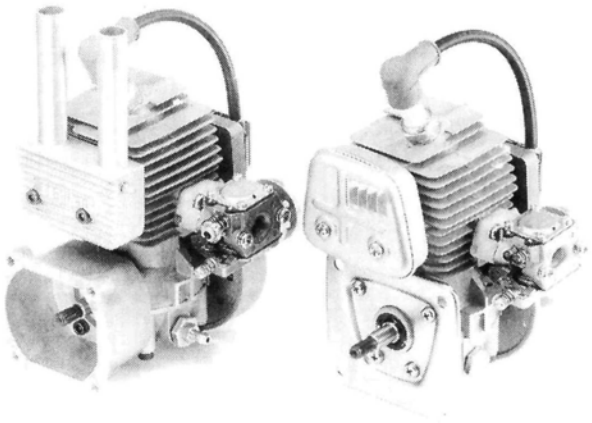
The Schnuerle porting employs a somewhat high exhaust timing of 158 degrees and allows a sufficient "blowdown" period of 22 degrees ahead of the transfer timing so that a tuned pipe would work well.

Compression ratio is undemanding at 6.34:1 effective. The combustion-chamber shape is "trumpet" style, and squish distance is 0.040 inch at its closest piston-to-head clearance.

The well-known Walbro diaphragm pump carburetor is used with the G-38 (it draws fuel from the open tank and pushes it into engine), and as usual, its no-nonsense way of dealing with fuel-delivery problems seems to be ideally suited to a model aircraft's varying flight patterns and G-loadings. Were it not for this carburetor's complexity and cost, surely its principles would have been universally applied to most model aircraft engines by now!

Unlike the small G-23 engine, the G-38 is not fitted with contact breaker points, and it also relies on a fixed ignition point based on the positional relationship between the rotating magnets and the ignition coil that's bolted to the front of the engine.

A standard, small box silencer was used during the test, though other specialist silencers are available; the Bennett* smoke muffler is one such shown in the photos. The crankcase base fitting provides pressure for the smoke muffler. The purpose-made radial cast mount is also shown for those needing yet greater engine length!



ISC's Zenoah G-38 (right) with standard silencer and pressed-steel radial mounting plate. At left, the engine is fitted with a Bennett smoke muffler and pressure tap at the crankcase base. The cast-alloy mount gives greater length for extra clearances.

PERFORMANCE

A mixed bag of propellers was used during and after a 40-minute break-in period. It's worth commenting though, that in the "industrial" setup, it is not likely that prior to making that first cut with your chain saw, you're going to run the engine at light loads and keep fuel settings rich and cool (as per most model-engine practice!).

The facts are that the engine is constructed to operate strongly virtually from the first pull-start, with a piston-skirt clearance of 0.003 inch and crown at 0.005 inch plus those various rolling-element bearings throughout, and an aluminum cylinder (likely to expand with heat at almost the same rate as the piston anyway). It would actually be rather difficult to get the engine to "tighten up" even if trying to do so. Nevertheless, old habits die hard, and so the usual care was taken in the early runs.

POWER TEST

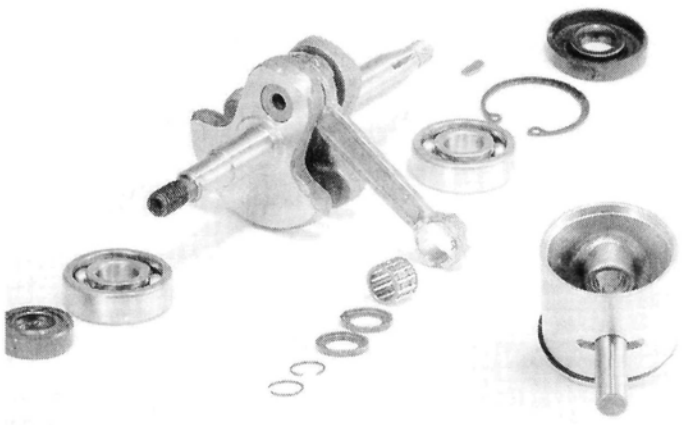
• **Test 1. Open exhaust.** Fuel—95% unleaded petrol and 5% Esso 2-stroke oil.

Torque figures confirmed the low-rpm capability of this engine, with full-load running possible without stress to just below 3,000rpm. At that point, 80 percent of maximum torque was still available, though the very gentle performance belied this. Maximum hp was reached at a fairly bracing 9,055rpm. As mentioned earlier, the indication (on this particular rigid dynamometer) was that 8,000rpm was, in practice, a more realistic, usable maximum.

Fuel consumption of 20cc per minute at 5,000rpm is less than half that of methanol engines of the same size, and this advantage occurs elsewhere in the rpm band.

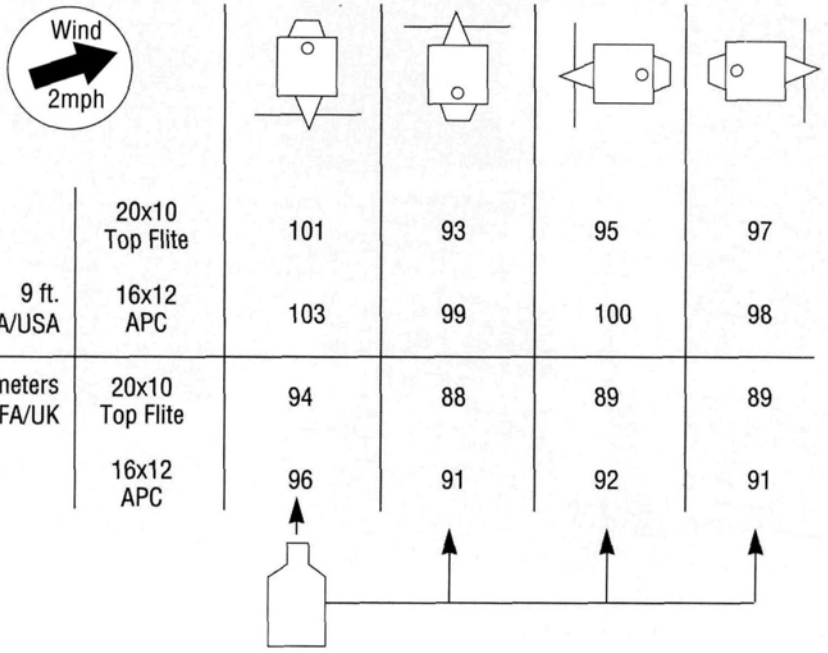
• **Test 2. Standard silencer.** Same fuel as in Test 1.

This industrial silencer is designed to be small enough to be used in portable chain saws, leaf blowers, etc. It performs a satisfactory job, given its limitations, but clearly, a large-scale model aircraft would more easily accommodate larger, more effective silencers—even a tuned pipe. The power-loss and sound-level figures arrived at here represent just the basic out-of-the-box levels. (A forthcoming test of the Walker Sachs-Dolmar 70cc, large-scale, single-cylinder engine is likely to include some purpose-made aircraft silencers/pipes.) Hp, torque and fuel-consumption figures were all reduced by 20 to 25 percent compared with the open-exhaust findings. Fuel-efficiency figures reached 550 sfc. (Specific units are cubic centimeters of fuel used in 1 hour at hp output.) This is a reasonably good figure for an off-the-shelf unit because, to get below 300 sfc, high-efficiency engines need to be constructed, and much development work is required.



The G-38 uses substantial single-row ball bearings to support the crankshaft rather than the "thin-wall" shell needle bearings seen on some other engines.

dB LEVELS
ZENOAH QUARTZ G-38cc



9 ft. AMA/USA	20x10 Top Flite	101	93	95	97
	16x12 APC	103	99	100	98
7 meters BMFA/UK	20x10 Top Flite	94	88	89	89
	16x12 APC	96	91	92	91

Engine: Zenoah Quartz G-38cc

Equip: standard silencer

Fuel: unleaded petrol

Temp: 46° F

Location: outdoors, adjacent to farmland

Date: November 17, 1993

Meter: Radio Shack (no. 33-2050) using GA601 calibrator set to NPL standard.

Height: both meter and engine set 1 meter above concrete.

rpm: 20x10—6,000

OTHER POINTS

• Idling at 1,200rpm was possible using the silencer and a 20x10 Mastro propeller (a slightly heavier wooden propeller than a Rev-Up).

• Starting the engine with an electric starter from cold requires minimal choke; hand-starting is difficult owing to (single-ring) soft compression at hand-cranking speeds.

• At higher rpm, the main fuel needle needs to be virtually closed mechanically, though it is still letting fuel through! At low speeds (say, 6,500rpm), the needle must be opened approximately 1½ turns. It is less sensitive than average model-engine control.

• A fair amount of air cooling is needed, so it may be unwise to provide too tight a cowl fit or restrict air throughways.

• Check and tighten the bolts that secure the mount to the engine.

• A Zinger 24x8 propeller is a nice, relaxing way to go for those seeking a really sedate flying experience.

SUMMARY

I have, to date, tested five of these well-known industrial conversions, and they have all exhibited similar useful and welcome characteristics. The combination of massive reliability, economy of operation, relatively low, undemanding rpm levels and trouble-free "automatic" ignition systems results in a significantly different model aircraft experience.

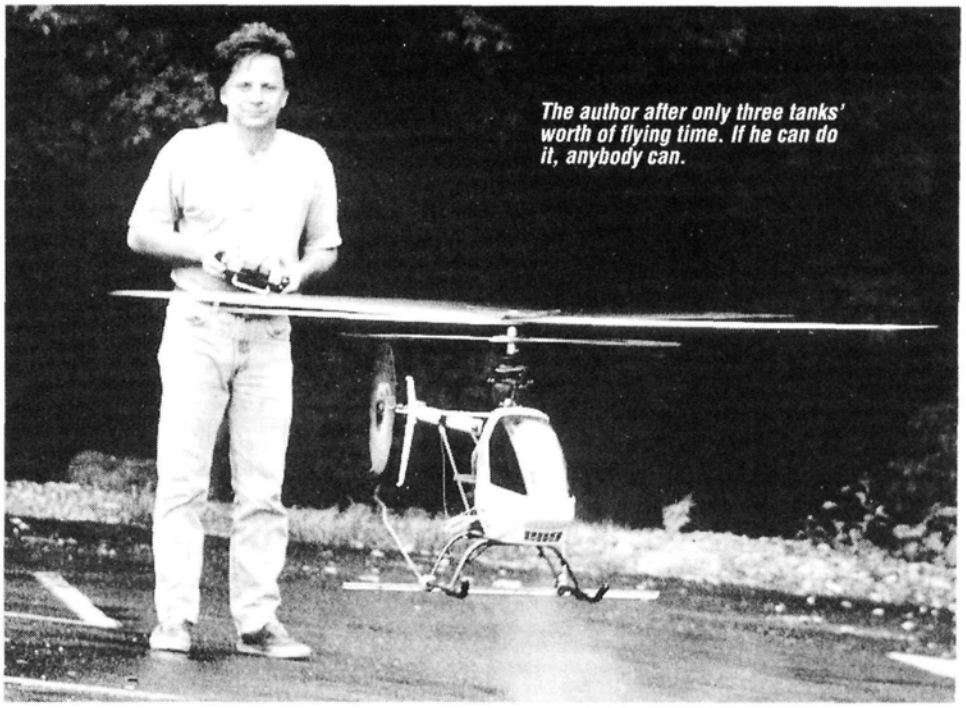
For some fliers, the G-38 may seem to be too large, representing a considerable investment in model structure alone (in which case, the fine G-23cc is a good compromise). Others, however, are coming to grips with ever larger units, making this 38cc engine look quite minuscule by comparison. We should be thankful for the variety that is available and to which the Zenoah range has added its long-lasting qualities.

**Here are the addresses that are pertinent to this article:*
***ISC Intl.**, P.O. Box 40116, Indianapolis, IN 46240.*
***Bennett;** distributed by B&B Specialties, 14234 Cleveland Rd., Granger, IN 46530.* ■

by CHRIS CHIANELLI

TAKE A SPIN

Reduce the hassle of heli entry



The author after only three tanks' worth of flying time. If he can do it, anybody can.

I LEARNED quite some time ago that the way to keep this hobby interesting and challenging is to try new things. As a sport flier, I've always done so—scale, pylon racing (Quickie 500), float flying and fun-fly designs. Why, then, was I like so many other Sunday sport fliers—so reticent when it came to helicopters when I found them so interesting?

The answer is simple: my perceptions of price and difficulty kept me away. One day, while watching a joyful pilot who was—only last week—a hover-only novice, happily mastering the techniques of forward flight, I decided it was my turn. It was obvious he was reveling in an R/C catharsis—something we all need from time to time. I was going to take the plunge. Here's how I took the dive without banging my head on the bottom of the "learning-pool."

THE MAJOR QUESTIONS

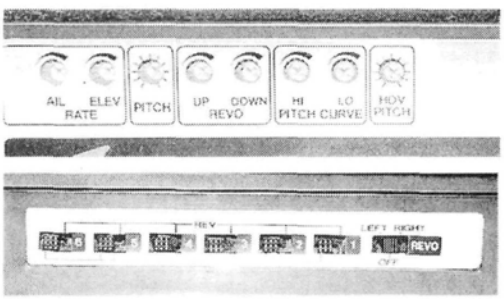
The first thing I did was ask the hottest rotary-wing pilots in the local clubs which was the best machine, as the experienced call it, to buy.

Now, this may be a local phenomenon, bu every hotshot in my area gave me the sam answer—Altech Marketing's* Hirob

The Hirobo Shuttle is a great machine to learn on and to progress with as your proficiency improves. This is an assembled ZX with Enya .35 heli engine.

HITEC FOCUS HELI 5

The Hitec Focus heli 5 transmitter with a fifth channel gear switch at left/top, and hover throttle adjustment wheel at right/top. Note the Rubber Duck antenna, which is excellent for heli use because it's short and emits a strong signal.



Above: aileron and elevator adjustment travel volume (ATV), pitch-trim, revolution up/down control, hovering pitch-curve high/low and hovering pitch-trim are accessible from the front panel. Below: bottom panel has servo reversing and left-off-right switch for selecting main rotor-head rotation direction.

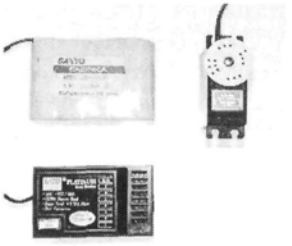
Shuttle. Their reasons also seemed to coir cide. It's a solid machine with rigidly pos tive mechanics that not only make a grea trainer, but also allow it to be upgraded, a proficiency improves, to an all-out compet tion machine. Sounded like a one-time pu chase to me.

The Enya .35 hell engine also got ver high marks from the local experts for i ability to cope with heli service on hot day I'm told an engine sag on a hot, humid da can be disastrous. Thankfully, I haven't y found out first-hand, using the Enya. It purely a coincidence that the Shuttle is avai able assembled with this engine installe This convenient combination was quickl purchased in Shuttle ZX form—the all-bal

bearing version. The assembled Shuttle Z, however, represents very good value. It costs only about $20 more (retail) than both the Shuttle Z kit and the engine. Remember, any Shuttle version is totally upgradable, and the Z version is fine for the beginning stages, which, for average sport pilots, will probably last the better part of a season.

CONTROLLING CHOICE

My next question dealt with which radio to use. The answer I got here was that they're all generally good. I've had very good results in terms of dependability with the product that Hitec* has been producing in recent years. Though their radios have fewer "bells and whistles" than others, their Focus Heli 5 will suit my needs just fine for a long time to come, and it's very] affordable—about $200 at a discount.



The Hitec Focus Heli 5 airborne components include a 1000mAh Sanyo battery pack, an RCD Platinum 8-channel receiver and five HS-422 43oz.-in. servos—the same as the HS-500 (pictured), but with an improved, dual, bronze-bushed output shaft.

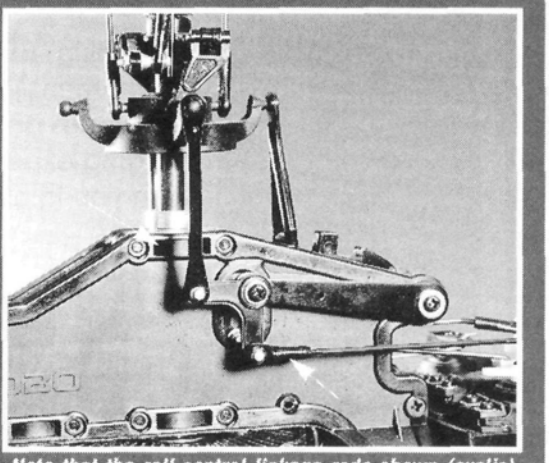
When it comes to the next decision—your instructor—you're on your own. I *will* offer this advice. If you don't feel comfortable with an individual, find someone else. It's your future hobby enjoyment and your $600 or $700 that are invested. Don't get me wrong; everybody I've come into contact with during my initiation remembered well what it was like to learn and were incredibly helpful and encouraging. We all know, however, that when dealing with people, it's not that hard to find a pompous pain in the you-know-what. If you're unlucky enough to find someone like this, tell him to take a hike. There are too many helpful guys out there to let some élitist taint the task at hand. Our own Dave "Dog-fighter" Baron was my instructor. A good teacher makes all the difference.

CLASS IN SESSION

All my training was done on a smooth blacktop surface—the smoother, the better. Dave told me of students he trained on ice. Those sideways landings don't end in a toppled chopper, broken blades and bent shafts. It's possible to do a "slide-into-home"-type landing on the ice without mishap. On a smooth surface, you can also work the controls slightly to watch the "disk" (the apparent disk of the spinning blades) react. This helps you to orient yourself with the cyclic control—very helpful thing to do before actually flying. Dave had me hover-

Setting up for the First Flight

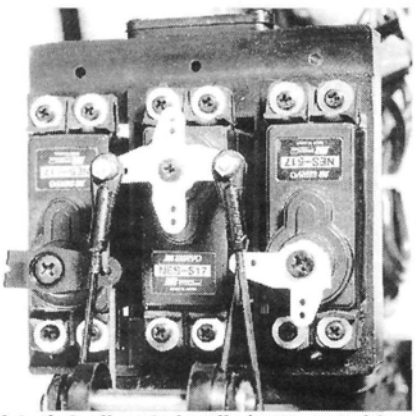
by DAVE BARON



Note that the roll-control linkage rods shown (cyclic) are mounted at 90 degrees to the bellcrank arms.

One thing I have found is that if a helicopter is properly set up, the time it takes a student to become comfortable in a simple hover is greatly reduced. It is important that a training helicopter be checked over and test-flown by a competent heli pilot to ensure that it has been properly adjusted. Failure to do this could result in the student's frantically working to correct artificially induced drift in the just-hovering heli, and this will work *against* learning how to fly the machine properly. Conditions at the flying site should also be as favorable as possible. If the learning curve is to be scaled in the shortest possible time, the following points should be taken to heart: .

• **LINKAGES.** Set the main rotor for zero pitch. The swashplate should be parallel to the rotor blades and stabilizer paddles. All the linkage rods descending from the swashplate to the transfer bellcranks must be perpendicular to the bellcrank arms to which they're attached. The rods between the bellcranks and the servos should also be perpendicular to the bellcrank arm. The point of attachment to the servo-output arm should also form a 90-degree angle.



Note that roll-control cyclic (center servo) has linkages that are symmetrically mounted.

These adjustments guarantee that you will have equal throw in all directions of cyclic travel (pitch and roll).

• **FLIGHT-AREA SURFACE.** The flight area should be as smooth as possible. Ice is perfect, as the machine can slide around without lifting off—giving the student a "feel" for the controls without being airborne. Ice is not available everywhere at all times—any smooth concrete or asphalt is the next best surface. Before flying, always sweep your flying pad to free it of dirt and dust, which will otherwise get into the exposed gears and bearings and shorten the life of your helicopter.

• **TRAINING GEAR.** Even highly proficient fixed-wing pilots will have to use training gear when they take on the challenge of learning to fly a helicopter. If you don't have access to ice, but have a clear area of asphalt to fly off, try this: attach small, golf-ball-size "whiffle balls" to the ends of two 5/16-inch-diameter hardwood dowels or Plexiglas rods that are about 2½ to 3 feet long. The dowels/rods should be tie-wrapped crosswise on the landing skids to form an "X" when viewed from above, i.e., the heli is positioned nose-in at your feet. Put small spacers on the rods on both sides of each whiffle ball so that the balls will be able to rotate when they slide along the ground. If you plan to learn to hover off grass, use softball-size whiffle balls. In many areas, pilots tie-wrap Hula-Hoops to the ends of extended rods.

• **FLYING OFF WATER**. If you fly off water using homemade floats or commercially available floats (made for airplanes or helicopters), be advised that all negative pitch must be removed, or the helicopter will tend to submerge upon rapid reduction of throttle!

• **FLARE**. Fixed-wing-aircraft pilots are prone to flaring their aircraft just prior to touchdown. To break this habit, and to reduce the likelihood of a tail-strike, helicopter students should be encouraged to push slightly forward on the stick at the moment of touchdown.

• **THROTTLE STICK.** The student will need to understand that the throttle stick is no longer an air-speed control. On a helicopter, it will only control altitude, and it is a very sensitive control! In a gentle hover, the proper position of the throttle stick is about midway along its throw range.

• **TAIL ROTOR.** Tail-rotor thrust is more sensitive when "pushing" in a direction that's opposite the direction of the main-rotor rotation, as seen from the aft end of the main rotor disk (because that main rotor imparts a counter-moment to the body of the heli, and the tail-rotor thrust combines forces with this moment). When the rotor pushes *with* the direction of the rotor, it is less sensitive as a control.

Approximate Discount Prices	
Shuttle Z (assembled; w/engine)	$430
Hitec Focus Heli 5 radio	$200
Hitec Gyro (GY-100BB ball bearing)	$85
Total	$715

ing by my third tank of fuel—without a buddy-box system! I attribute this mostly to having a solid machine and a great instructor with a confidence-building demeanor. Cockiness did infiltrate my persona, however.

TO THE CLINIC

I had the pleasure of attending the Hirobo Cup in New Jersey this past August to check out the clinic portion of the event, where Tim DiPeri, John Jabour and Handi Homann of GS Hobbies in Old Bridge, NJ, gave me a lot of help. I also got to see that good-natured world champion Curtis Youngblood do the most amazing things I've ever seen done with a helicopter anywhere with his free-form exhibition. He's the best; end of story.

If you have a great instructor and don't succumb to cockiness, as I did, it's quite possible your learning stages could be devoid of such "glitches."

Anyway, during the clinic, I was hovering away confidently (I would have lit a cigarette had I the habit what a jerk) asking those who were telling me how great I was doing to please repeat themselves when I executed one of my famous "slide-in-to-home" landings on the wrong surface. You guessed it—grass! My machine toppled, doing an impression of a flimsy roto-tiller (that cigarette would have fallen out of my mouth, for sure). My first crash had happened, albeit with very little damage.

All I could see was Sensei-Baron shaking his head. Everyone quickly told me that this is part of the game, and they related stories of their—far worse—crashes. If you have a great instructor and don't succumb to cockiness, as I did, it's quite possible your learning stages could be devoid of such "glitches." But if it does happen, don't let it get you down. It's rumored that the world champ was once overheard proclaiming laughingly, "Why sure; I crashed only two weeks ago!" Of course, he is constantly on the edge of the envelope. Wouldn't you like to be?

**Here are the addresses of the companies mentioned in this article:*
Altech Marketing, *P.O. Box 391, Edison, NJ 08818-0391*
Hitec/RCD, *10729 Wheatlands Ave., Ste. C, Santee, CA 92071.* ■

by MIKE MAYES

PHOTOS BY MIKE MAYES

Battery Management System One: the name says it all. It's reliable, well-constructed and simple to operate.

RK ELECTRONICS'

Battery Management System One

A tool for proper maintenance of Ni-Cds

HAVE YOU EVER considered how long your radio-control system would work after the batteries go dead? The answer is: not long enough!

Batteries are one of the most important items in an R/C system; unfortunately, they are the most common area of failure.The function of the Battery Management System One (BMS One), marketed by RK Electronics*, is to allow users to properly maintain the Ni-Cd batteries used in today's R/C systems. Discharging the cells with a battery management system such as BMS One lets you determine the condition of your batteries and clears any residual memory effects that may have built up in the cells. The circuit design in the BMS One charger is based on Mosfet and operational amplifier technology. The charger has three output channels, which I will discuss in detail.

GENERAL INFORMATION

The BMS One charger is a true constant-current battery charger and cycler; it can discharge both the receiver and transmitter batteries at the same time. With respect to cycle time, it has a definite advantage over cyclers that put the battery packs in a queue and can only discharge one battery pack at a time.

OPTIONS

Before using the BMS One, you must first select a few simple options that meet the charging and discharging requirements of the batteries you will be working with. The BMS One can discharge TX battery packs of eight or nine cells and RX battery packs of four or five cells.

NUMBER OF CELLS

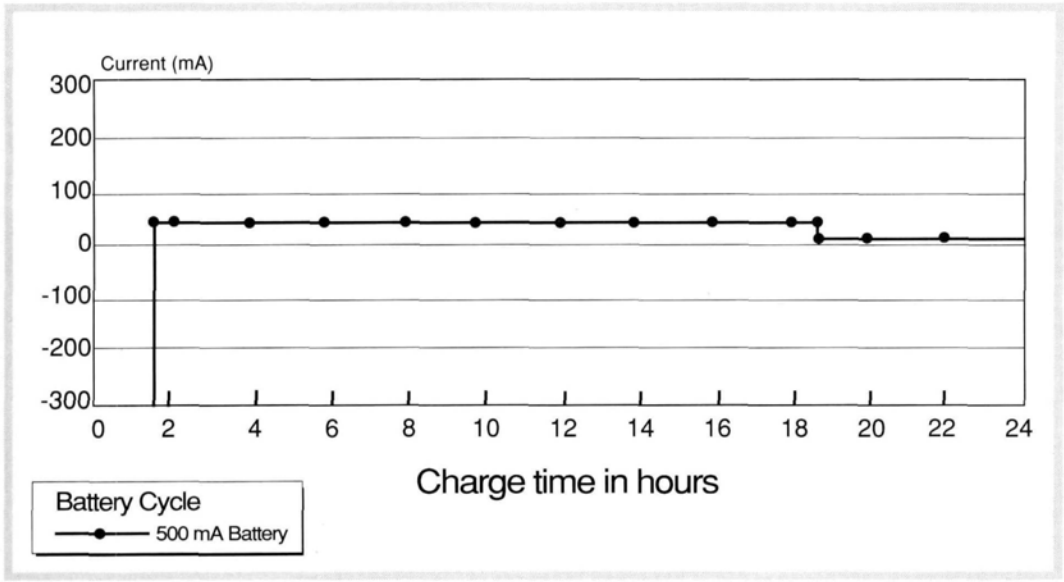
Two switches are used to match the BMS One to the number of cells that you are working with. You can select either eight or nine cells with the TX switch; you can select either four or five cells with the RX switch. These two switches set the minimum voltage to which the BMS One will discharge. This minimum voltage level is calculated like this: 1.1 volts multiplied by the number of cells. If you have a 4-cell receiver battery pack, the BMS One will discharge that pack to a voltage level of 4.4 volts.

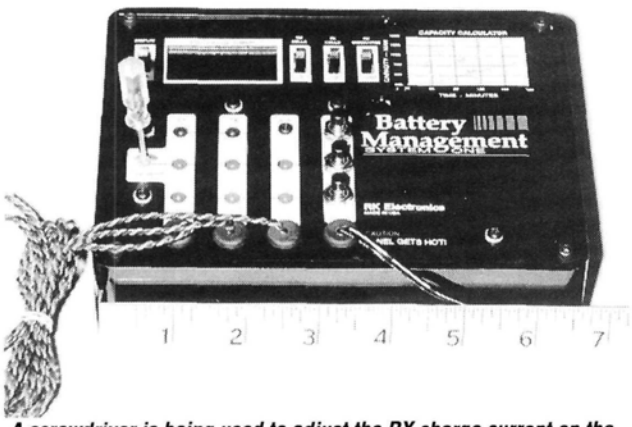
DISCHARGE RATE

The discharge rate is selectable at either 300mAh or 500mAh. The operator's guide for the BMS One indicates that, in most circumstances, you should use the 300mAh discharge rate. If you use a 1000mAh receiver battery (or one with a higher capacity) in a giant-scale application, you should use the 500mAh discharge rate. If you have a milliamp ammeter, another way to select the best discharge rate is to measure your flight system's actual current draw while you manually operate the servos as if the flight system were in flight. Because the servos don't have the same loads when they're not in flight as they do when they are in flight, the measured current will be slightly less than the actual in-flight current. But you can use this reading to select the 300 or 500mAh discharge rate that comes closest to matching your system.

SPECIFICATIONS

Function: Battery maintenance
Input voltage: 110 volts AC at 60Hz
Charge capacity: One to nine cells
Discharge capacity: TX—eight or nine cells; RX—four or five cells
Display: Three-digit numeric; one-line LED
Number of output channels: Three
Discharge rate: Programmable—300 or 500mA
Dimensions: 6.9x5.3x2.3 inches (without leads)
List price: $189.95





A screwdriver is being used to adjust the RX charge current on the left-hand side of the operator panel.

Note: when you're cycling batteries, remember that the best way to check the condition of a battery pack is to compare its latest discharge characteristics with previous discharge characteristics of the same fully charged battery using the same discharge rate. For example, when you charge a 500mAh battery pack, the battery is charged at a C/10 rate of 50mAh for slightly more than 17 hours. Then the charger automatically switches to a C/50 rate of 10mAh and maintains the batteries on trickle-charge.

RECEIVER-BATTERY CURRENT ADJUSTMENT

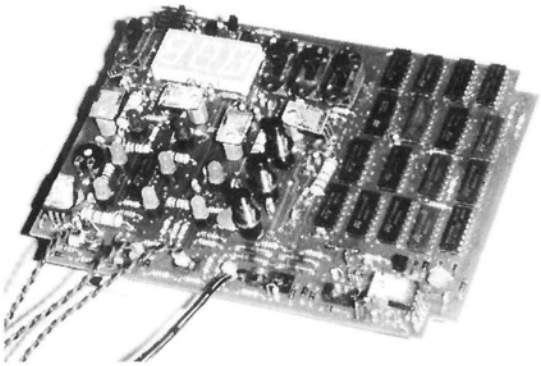
You can adjust the receiver-battery charge rate by using the trim pot under the front panel. The receiver-battery charge rate has an adjustable range from approximately 1 to 200mA. The correct way to set this current adjustment is to put a milliamp ammeter in series with the battery, and adjust the current flow to the desired setting based on the battery capacity.

CHANNELS

The BMS One has three channels, all of which are designed to charge battery packs of one to nine cells in 17 hours, 4 minutes.

• **Channel 1** has an overnight charge rate that's adjustable from approximately 1 to 200mA. (The charge rate comes from the factory preset to 50mA.) After charging, the charger drops from the overnight charge rate to a trickle-charge rate of 10mA. This channel is also capable of discharging both 4- and 5-cell receiver packs at a constant-current discharge rate of 300 or 500mA.

• **Channel 2** has an overnight charge rate that's fixed at 50mA. After charging, the charger drops from the overnight charge rate to a trickle-charge rate of 10mA. This channel is capable of discharging both 8- and 9-cell transmitter packs at a constant-current discharge rate of 300mA.

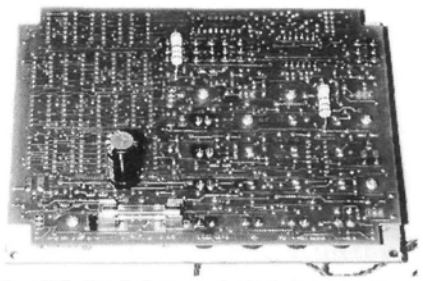


The printed-circuit board. A lot of electronic components are used to control the BMS One's operation.

• **Channel 3** has an overnight charge rate that's fixed at 125mA. After charging, the charger drops from the overnight charge rate to a trickle-charge rate of 25mA. This channel is not capable of performing the discharge operation. A typical application for this third channel would be charging a Ni-starter battery, an on-board starter, or a gyro battery for a helicopter.

CONTROL PANEL

The control panel is simple and well-laid-out. The timer display consists of three large numeric LEDs that are easy to read. Operation is straightforward and requires a minimal amount of reference to the operator's guide. LEDs display the charge/discharge status: the red LEDs indicate that the channel is in a discharge cycle; the green ones indicate a charge cycle; the yellow ones indicate a trickle-charge; and if no LEDs are illuminated, there's no current flowing.



The BMS One is fuse-protected. As you can see, the fuse is on the rear of the printed-circuit board.

One innovative feature that I really like is the battery capacity calculator graph that's printed in the upper right-hand corner of the control panel. It allows the user to quickly calculate the battery capacity based on discharge time and rate.

POWER SUPPLY

Power for the BMS One is supplied by a small external power module. The power supply is designed to operate from a standard 115V AC household outlet; its output is low voltage (14V AC). This external power supply is a good application for the BMS One because any heat generated from the power supply is isolated and won't affect the charge or discharge circuit.

**Here's the address of the company featured in this article:*
RK Electronics, *330 Fox Run, Hudson, NH 03051; (603) 882-6022.* ■

MODEL AIRPLANE NEWS MAGAZINE

FIELD & BENCH REVIEW

SIG 4-Star 120

GIANT-SCALE SPORTSTER

by DICK PURDY

PHOTOS BY MATT TAYLOR

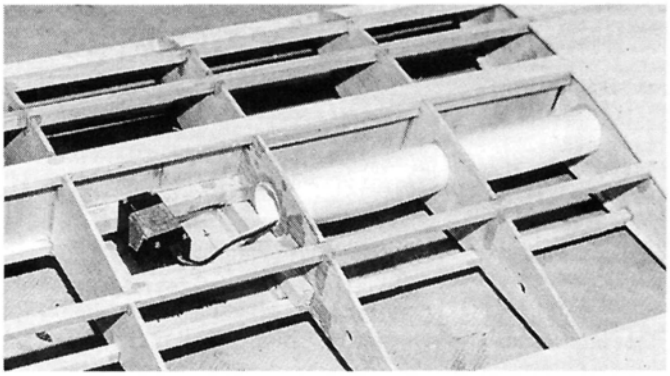
BACK IN 1989, those crowd-pleasing folks in Montezuma, IA, introduced a new model for the R/C pilot: the Sig* Four Star 40. Sig's Bruce Tharpe has taken that successful design and created a new, larger version with engine ranges of .90 to 1.20 (2-stroke) and 1.20 to 1.60 (4-stroke). I have recently completed building and test-flying this new creation and can tell you without reservation that I am totally delighted with it. The kit was quite easy and quick to build, and it is a great joy to fly.

This plane has an 81-inch wingspan with square wingtips. If you elect to add rounded tips of conventional design, the span would come in at about 85 inches. With or without special tips, the size still qualifies it for entry in IMAA fly-ins. This is a single-piece wing, however, so you must be able to transport it to your flying field, of course.

The kit includes all the wood material required, and many of the parts are either die-cut or preformed to minimize the builder's labor. One sheet of balsa was missing from my kit, but this was a "first-run" kit, and Sig notes subsequent runs will not have that shortage.

A complete set of hardware comes carefully bagged. (This is all top-quality stuff.) There are preformed wire parts, a canopy, a landing gear, decals and nice, new, heavy-duty plastic pushrods that Sig now offers. There is even a sturdy reinforced-nylon engine mount for 1.20-size 4-stroke engines. I was very pleased with the tail-wheel bracket and wire gear included; this proved to be the best functioning unit I've used in many a moon. Two large plans sheets that show full-size construction details, a well-illustrated 24-page manual and a booklet called "Basics of Radio Control" are all part of the kit.

Not included are the engine, prop, fuel tank, fuel tubing, wheels, pilot figure, covering materials and adhesives. And, of course, you must furnish your own radio. Since a servo is placed in each wing panel for aileron control, a total of five servos is required. I used a standard 42 oz.-in. servo for the throttle and 55 oz.-in. servos for the elevator, rudder and each aileron. I opted for a 3-inch-diameter spinner (also furnished by the builder), although the plans show a 2¾-inch size.



Note the paper tube used to route servo wires to the aileron servo.

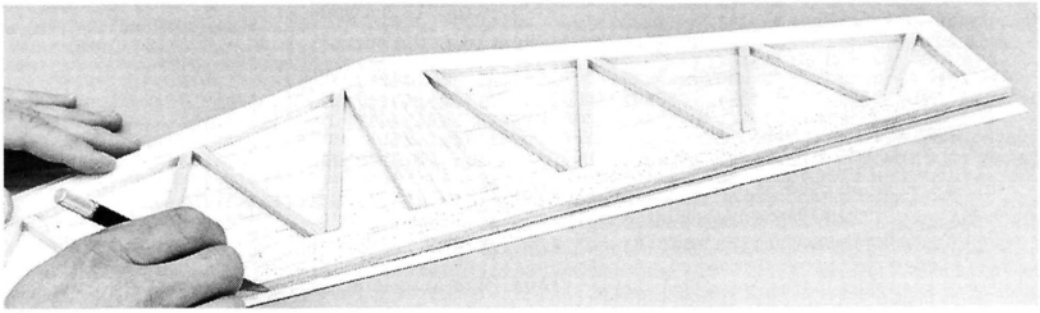
CONSTRUCTION

• **Wings.** I started construction with the wing. The wings are built in halves, and the wing panels are built of die-cut balsa ribs and spruce spars. Three sizes of shear webbing for the main spars are provided, with each size banded together for convenience and identification.

Rather than using the usual sheet balsa at the wing's leading edge, Sig uses ¼-inch-square balsa longitudinal sticks, or "turbulators," to attain the form of the airfoil required while giving the strength and very light weight desired. Paper tubes that are inserted into holes in the wing ribs form a channel for the servo leads that run out to the ailerons. It is a very lightweight solution to a necessary detail. When each wing half is done, the halves are epoxied together with a birch-plywood wing joiner. The wing's center section is then sheeted for added strength at that critical area. Preformed balsa ailerons are fitted with the Easy Hinges supplied, but are not glued into place until the covering has been applied later.

• **Fuselage.** The fuselage is a matter of assembling die-cut poplar lite-ply pieces with CA. I used Hot Stuff* for my assembly steps, and I must admit that I had forgotten what a good-quality product it is. The dispensers that come with both the thin and thick versions have long applicator tips, which I like, and the adhesives do a fine job.

Preformed plywood slab sides, bottom and formers come together into a rugged but lightweight fuse in a remarkably short time. The plywood firewall slips into place precisely to give the proper thrust angle for the engine. It is hard to goof up with such well-cut parts and an intelligently written guide book to follow. I added stringers to the upper formers to create a turtle deck, and the fuse was finished in just a few hours.



The sheeted horizontal stabilizer is of stick construction.

A formed, heavy-duty aluminum landing gear bolts to a plywood plate on the fuselage bottom. This mounting plate is just forward of the wing's leading edge, where the mounting plate for the wing-support dowels is also located. This section is very well reinforced because so much stress can be concentrated there. The landing gear has a nice wide stance that benefits ground handling. Although it's not particularly high, the landing gear does provide adequate clearance for a prop of up to 18 inches.

• **Tail group.** I built the tail feathers next. The design calls for a framework of balsa sticks that are then sheeted with 1/16-inch-thick balsa. You end up with a very light but strong stabilizer and fin members that support solid sheet-balsa elevators and rudder surfaces. The control horns on the ailerons, rudder and elevators have plywood bearing plates let into the balsa control surface for strength.

SPECIFICATIONS

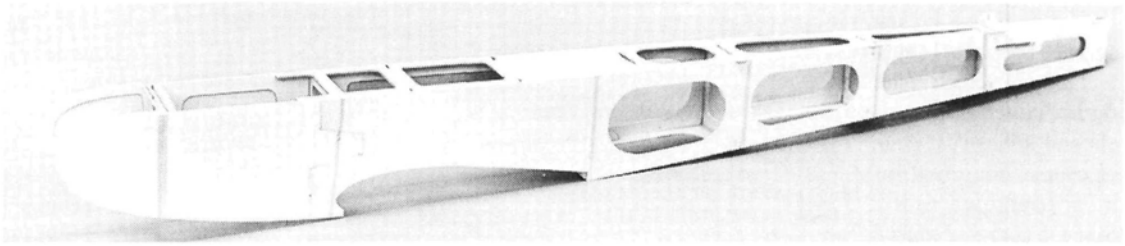
Model name: Four Star 120
Type: low-wing sport
Manufacturer: Sig Mfg. Co.
List price: $179.95
Wingspan: 81 in.
Wing area: 1,200 sq. in.
Weight: 11 lb.
Wing loading: 21.1 oz. per sq. ft.
Airfoil type: semisymmetrical
Length: 65 in.
Recommended engine size: .90 to 1.20 (2-stroke); 1.20 to 1.60 (4-stroke)
Engine used: O.S.* Surpass 120 with pump
Prop used: APC* 16x10
Number of channels req'd: 4
Radio used: Futaba UAF 7
Kit construction: all built up

Features: light weight gives low wing loading, and this results in a great aerobatic sport flier. The kit is complete and contains high-quality parts throughout. Die-cut plywood and balsa parts fit together well. The structure is quite rugged despite its light weight. This kit can be completed quickly and easily, and the excellent manual makes it hard to go wrong.

Hits
- Ease of construction.
- Light but sturdy.
- A terrific fun flier; sporty appearance.
- Large wing area allows very low landing speeds.
- Generous amount of pre-shaping of components speeds completion; good die-cutting.

Misses
- There are no misses on this one!

Now I went back to the fuselage to outfit its interior. The built-in plywood floor for the fuel tank is placed at a proper height for the engine carb. A cavity under this floor accommodates the Ni-Cd battery. You can also slide the receiver into that cavity, in case balancing your craft should require it. Nearly any size servo will fit in the capacious fuselage.

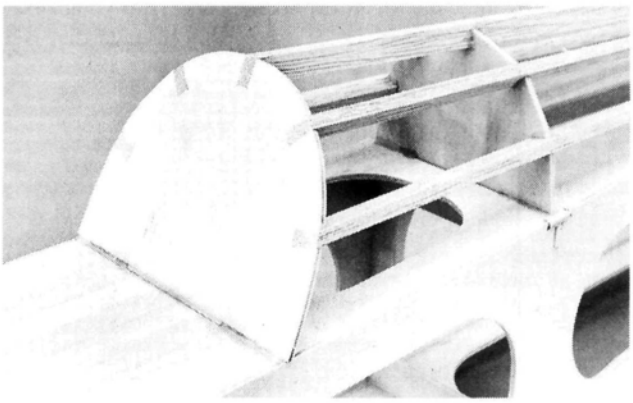


The fuselage shows the light, strong construction that is typical throughout this kit.

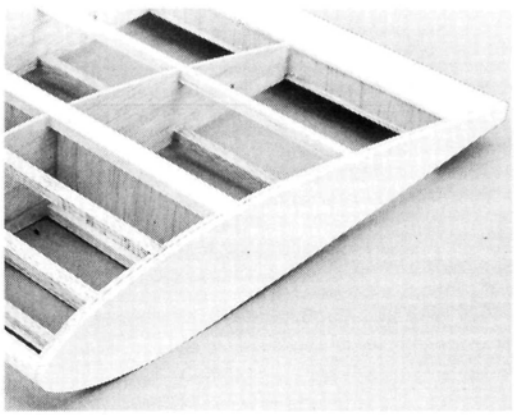
I installed the heavy-duty Sig plastic pushrods next. Two sets of intermediate supports for the pushrod sleeves were inserted in the aft portion of the fuselage to eliminate slop. After I had applied a coat of alcohol-thinned epoxy to fuelproof the firewall, I added the fuel tubing, the throttle servo and pushrod and the engine mount.

• **Covering.** At this point, I went over the surfaces of all the component parts with balsa filler and sandpaper. I decided to try Oracover from Hobby Lobby* for this project. It took four rolls of Cub Yellow and one roll of Dark Blue to execute the color scheme I wanted. This plane is not particularly difficult to cover since it has lots of flat surfaces and simple wingtips, etc.

My experience with the Oracover turned out to be a spectacular success because it went on with such ease and was so simple to control at all times.



The turtle deck uses traditional longeron construction.



Note the stabilators between the main spar and leading edge.

When the wing, tail and fuselage had been covered, I used Oracover for the trim, and the adhesion was 100 percent. Next I applied the self-adhesive decals supplied with the kit. By applying a thin film of detergent and water first, the decals slide into position just where you want them. Sponge off the excess water, and the job ends up looking spiffy.

The only construction steps then left to do were the installation of all those Easy Hinges, control horns and pushrods. Then I mounted the radio gear, with the switch and charge receptacle, followed by the engine, fuel tank, landing gear and tail wheel. Finally, a pilot figure had to be painted and installed, and his canopy enclosure put over him. Everything was ready, so now it's show time! (See "Flight Performance.")

FLIGHT PERFORMANCE

• Takeoff and landing

Flight-testing this lovely lady was a truly memorable experience for two reasons: first, because it performed its entire program with flawless precision, and second, because my pal Jim Onorato did the honors as test pilot so I could stand by and watch. It took off in about 50 feet of runway, clearing ground in a smooth, dead-straight rise; then it climbed in a right turn to a safe altitude for a test of its capabilities.

The final test on this initial trial flight was the landing, of course. The approach was slow, gentle and fully under control every inch of the way. A flattening out of the glide path made it slow even further. Then, with a soft-as-a-feather flare-out, it settled down to a picture-perfect, three-point first landing.

• Slow-speed performance

We tried some simple stalls to see whether the plane would fall off to either side. However, at a very slow speed, it stalled straight ahead every time.

• High-speed performance

This plane was not designed as a high-speed flier, but it does fly smoothly and solidly at faster speeds, and it tracks well.

• Aerobatics

We tried a few loops, and they came out as true circles every time. The O.S. 1.20 ably flew the plane through standard maneuvers at about one-third throttle. For aerobatics, we simply increased throttle as required. Snap-rolls were not so very crisp, although certainly acceptable. Slow rolls were as precise as I've ever seen them done. Spins were good, and recovery was quick and positive. I was surprised by how easily this plane flies in knife-edge. Inverted flight was another pleasant surprise. It took only a smidgen of down-elevator input to keep the nose exactly where it should be, and then it was fun unlimited.

CONCLUSION

I really am in love with this airplane. If you are at all interested in large projects and sport-flying models are your thing—or you'd like to try them out—here is a kit that I can recommend with great enthusiasm. My hat is off to Sig and to Bruce Tharpe, the accomplished designer, for giving those in the hobby an easy-to-build, easy-to-fly giant-scale sport plane.

**Here are the addresses of the companies mentioned in this article:*

Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*

Hot Stuff; *distributed by Satellite City, P.O. Box 836, Simi Valley, CA 93062.*

Hobby Lobby Intl., *5614 Franklin Pike Cir., Brentwood, TN 37027.*

O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

APC Props; *distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.* ■

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

A contest-capable .60-size sport machine

by MIKE CINGARI

HIROBO Tsurugi

Sword of the Samurai

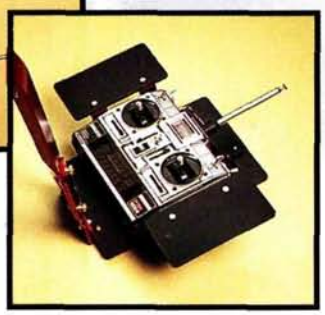
THE TSURUGI (the "t" is silent) is Hirobo's newest entry into the competitive 60-size helicopter market. It was designed from the ground up specifically for the USA and European style of aerobatic flying. Although it's a new design, the Tsurugi uses a few components from the Hirobo Eagle series of helicopters.*

FEATURES

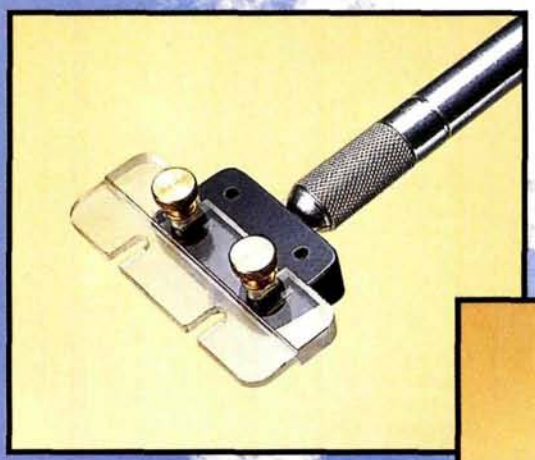
The Tsurugi sets itself apart by offering many standard features that are optional on other 60-size machines. One of the most desirable features on a modern R/C helicopter is a tight, slop-free control system. The Tsurugi comes stock with a push/pull, cyclic and collective-pitch control system. All of the linkages for this system are located between the frames of the helicopter. Everything that's located between the side frames can be easily inspected and adjusted. Also, less damage will occur in the event of a mishap.

The Tsurugi uses the wide-body type of aluminum side frames. The side frames are flat and have equal spacing from the top to the bottom of the helicopter. An aluminum angle reinforces the bottom of the frames. This type of assembly produces a very rigid structure and makes assembly of the helicopter's internal components very simple.

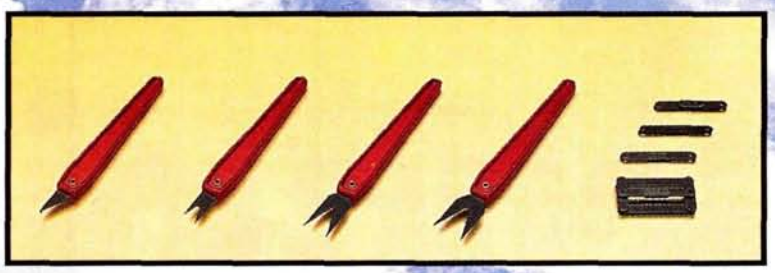
Aim High.



Radio Transmitter Tray - allows the modeler complete control. It is ergonomically designed with full adjustments of the aluminum shoulder straps and palm rest. **NO. 620**



EZ Trimmer - works like a "straight edge on a knife", It features an adjustable see-thru trim guide with 4 trim sizes, 1/16", 1/8", 3/16", and 1/4". Comes with two #19 knife blades. **No. 661**



Hinge Slotter Kit - *makes slotting control surfaces for glueing hinges easy.* The centering/parallel guide, centers hinge slotter on up to 3/4" material. The kit includes: 4 handles, a guide, and a centering tool for three different size slotting forks; mini, standard, and heavy duty hinges. Designed to work with all DU-BRO hinges. The 3 slotters and the "picker" are permanently mounted to red nylon handles. **NO. 660**

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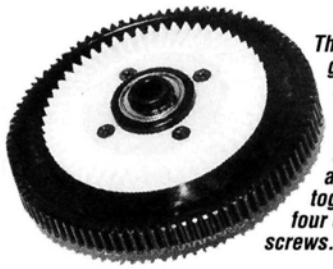
Flying the Tsurugi

The Tsurugi is a very smooth, docile flying machine. The new main rotor-head design in conjunction with the large, weighted, CG-corrected paddles and long flybar make this one of the easiest machines to hover. It has a unique engine sound owing to the 9.5:1 gear ratio; this ratio allows the Tsurugi to run head speeds from 1,200 to 1,700rpm. I settled on a head speed of 1,600rpm; at this speed, my engine turns approximately 15,200rpm. The stock blades didn't track well over 1,600rpm. I tried a set of 660mm symmetrical fiberglass blades on my machine and ran the head speed up to 1,700 without any tracking problems.

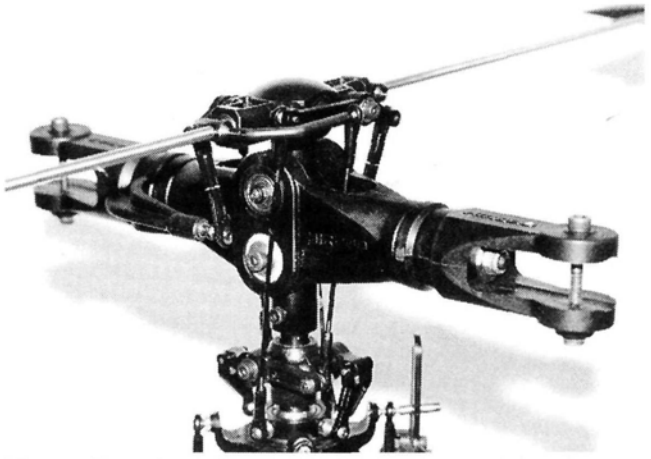
Upstairs, the Tsurugi tracks extremely well at all flight speeds, and it required very little trim changes. The large rotor disk and balanced control response make it very easy to fly at high speeds. The large size and weight of this machine provide ample inertia, which makes aerobatics smooth and effortless. A variety of loops can be performed, and rolls are crisp and axial. Tail-rotor response is smooth and precise for normal flying but, for wild aerobatic "3-D flying," a torque tube and improved tail-blade bearings and blade holders are needed to provide tighter control.

With the stock blades, autorotation performance was average, but with glass blades, it was fantastic! Blade inertia was greatly increased, providing adequate leftover power for soft, gentle autorotating touchdowns.



The main drive gear and the tail-bevel gear are molded in two pieces and fastened together with four countersunk screws.

The collective servos and the throttle servos are mounted directly to the inside of the side frames, which eliminates the need for a separate servo tray and simplifies the construction. The cyclic servos are mounted in a sliding tray that pivots on one ball bearing and three bushings. This tray moves forward and backward in a parallelogram fashion to provide collective control. This system supports the swashplate at all four points through a series of simple levers and produces tight, positive, cyclic control. The collective-pitch lever is the only ball-bearing-supported point in this system. I would have liked it better if at least the cyclic levers had ball bearings.

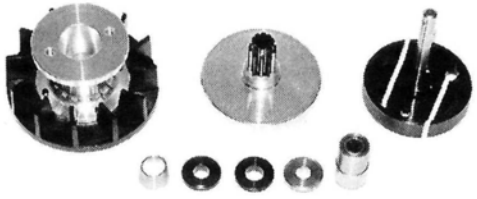


The new Tsurugi rotor head has an aluminum center hub with a plastic molded yoke and massive blade grips.

ENGINE AND CLUTCH

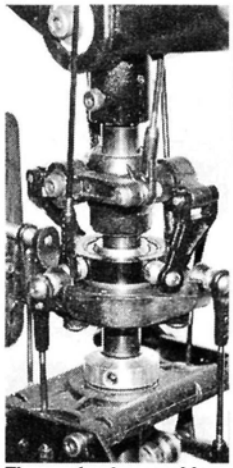
I'm using the latest version of the Enya* 60 heli engine—a ringed engine that comes with the new, two-needle (TN) carburetor. The engine is installed in the Tsurugi with its cylinder head toward the front of the helicopter. I had to mount a remote glow-plug adapter to light the glow plug. The 17-ounce fuel tank is located slightly aft of the CG, and it's highly visible. It can be moved left or right to clear the exhaust system. The mounting platform for the gyro is located directly above the fuel tank.

All of the Hirobo helicopters that I have flown have excellent engine cooling. The Tsurugi is no exception. A high-efficiency cooling fan made of plastic creates ample airflow to cool the engine. The fan is mounted on a nicely machined aluminum hub. The fan/hub assembly is mounted on the engine with a tapered collet on the bottom and an adapter on the top. Three adapters are supplied to fit Enya, O.S.* and YS* engines.



The high-efficiency cooling fan and drive-train system are self-aligning, nicely machined and adapt to a variety of engines.

After you install the tapered collet, set the fan hub down over the crankshaft. Next, install the correct centering adapter, and tighten the crankshaft nut. One technique that I have found useful when tightening the fan assembly onto the engine is to first remove the carburetor and insert a piece of wood or nylon through the crankcase and into the crankshaft port to lock the crankshaft and keep it from turning. This technique allows adequate torque to be applied to the engine nut without damaging the fan or the engine.



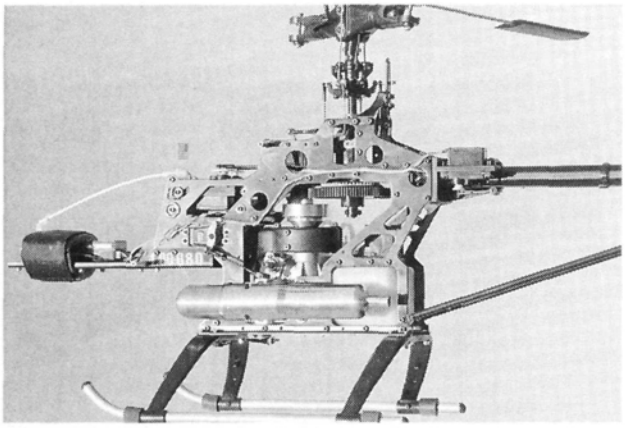
PHOTOS BY MIKE CINGARI

The washout assembly, the swashplate and the anti-rotation device move smoothly throughout the 20 degrees of available pitch travel.

Next, the one-piece clutch with a short clutch shaft bolts onto the fan hub. The combination of the collets and the short clutch shaft eliminates the need to dial-indicate this assembly. The clutch bell goes on next. A one-way starting coupler has been mounted on the top of the clutch shaft. Unfortunately, the starting shaft is not included in the kit. It would be a nice touch if the 6mm starting shaft was included in future kits.

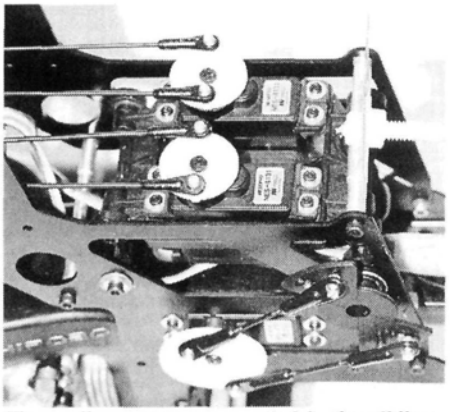
ROTOR HEAD

The rotor head is assembled and designed specifically for the Tsurugi. The center hub of the head is made of machined aluminum. The yoke pivots on ball bearings that are located directly above the blade axis, and its movement is dampened by a rubber isolator that's mounted below the blade axis. The yoke is molded of high-strength, carbon-fiber reinforced plastic. The blade spindles are insert-molded into the yoke at 0.5 degrees of coning angle. The massive blade holders are also of molded plastic, and



Many of the linkages are located between the frames for good protection. They can be easily inspected and adjusted.

they're reinforced with an aluminum insert that serves as the bearing bosses for the blade grips. The rotor head has very few parts, and it's simple and very strong. The molded plastic seesaw comes installed, and ball-bearing, aluminum, mixing-arm levers are mounted on it. One of the mixing arms in my kit was inverted, so I had to remove it



The cyclic servos are mounted in the sliding tray and are moved forward and aft by the collective servo to change the main rotor pitch.

and install it correctly. The seesaw assembly is located above the head and incorporates a curved top on the seesaw body that serves as a head button. The flybar paddles are covered with the supplied black stick-on covering. They're balanced for correct CG, and they weigh just under 50 grams. The combination of a long flybar and the heavy paddle weight help to make the Tsurugi a stable flying machine.

CONTROL SYSTEM

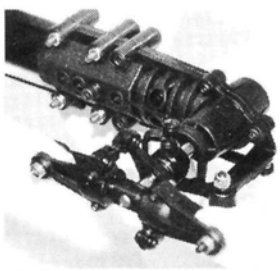
To reduce play, the washout assembly has two inserts installed that fit tightly when the washout is placed on the main shaft. It was necessary to break in these bushings by running them on a 10mm shaft that spun in my drill press. This cured the tight fit and reduced the control-system drag to an acceptable level. A guide pin threads into the washout block and engages a slot in the main shaft. This prevents the assembly from rotating.

The Tsurugi comes with a newly designed in-line swashplate. The inner ring of the swashplate is aluminum, and the outer ring is of molded plastic. The outer ring is fastened to the inner ring from below by four screws. This assembly has replacement steel pivot balls located on all eight points and engages a plastic radius arm to prevent rotation. This swashplate is as tight as any all-metal one, and it contributes to the overall tight feel of the Tsurugi.

MAIN SHAFT AND DRIVE GEAR

The main bearing and the tail-bearing blocks can be installed for either the stock 9.5:1 gear ratio or an optional 9.7:1 gear ratio. Make sure that you install these blocks with the raised number "95" facing forward. Failure to do so will result in problems with the main gear and bevel gear meshes.

The main shaft is 10mm in diameter and steps down in diameter to where it installs into the autorotation bearing



The tail-rotor assembly is simple and works well.

assembly. The shaft and the autorotation unit are pulled up against the lower bearing block and are held in position by a mast lock collar that slides down against the upper bearing block. This eliminates any unwanted vertical movement of the main shaft.

The main drive gear and the tail bevel gear have been molded separately and are held together with four countersunk screws. Don't over-tighten these screws; you can warp the bevel gear. Lightly lubricate the bevel gear with the supplied grease. The gear mesh is non-adjustable; however, the gears turn freely with the bearing blocks correctly located.

TAIL END

A 2mm drive wire that runs through a stainless-steel tube drives the tail-rotor system. Be sure to lubricate the drive wire before final assembly. This tube is supported in the octagonal tail boom by three supports. The drive wire fits into the tail transmission and is secured with four setscrews that are positioned 90 degrees apart. The wire has a flattened end on the front that slides into the bevel gear output shaft.

The tail gearbox comes assembled, and it spins very smoothly. Upon opening this unit, I noticed two things: helical gears were used inside, and the bearings were not secured to the two 6mm shafts. I applied a small amount of green, bearing-retaining compound to the shafts where the bearings rest, and then I slid the bearings into position. The bearing-retaining compound ensures that the inner bearing race and the transmission shaft spin together. The tail-rotor, pitch-change mechanism works very well from full left to full right with no binding. The tail-rotor control servo is boom-mounted and helps provide a more positive tail-rotor response. This feature also makes disassembly of the Tsurugi very easy.

The tail-rotor hub is a solid one-piece design with no damping. To help keep the cost down, Hirobo did not provide double ball-bearing blade holders on the tail. The tail-rotor blade grips are supported by a single thrust bearing. Some slop was present in this assembly, but it wasn't noticeable in normal flight. This may work fine on a Shuttle, but I expected more support for the tail blades on a helicopter of this size and price.

SPECIFICATIONS

Main rotor diameter: 60 in.
Tail-rotor diameter: 11 in.
Weight (ready to fly): 10.2 lb.
Length: 52.5 in.
Engine size: 60
Radio: 5 servos
List price: $950

Features: pre-assembled rotor head and tail-rotor transmission; push/pull control system on collective and cyclic servos; self-aligning fan and clutch system with one-way starting coupler.

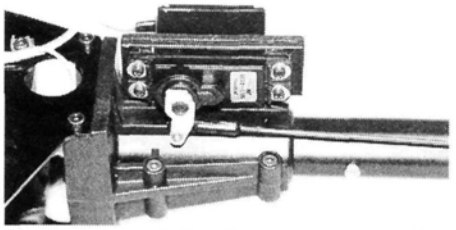
Hits
- Straight sideframes produce a rigid structure that's light and strong.
- Rear-mounted tail-rotor servo for more precise control.
- Very simple to build with minimum parts count.
- Large 17-ounce fuel tank is highly visible in flight.

Misses
- Tail-rotor blades are supported by a single thrust bearing.
- Because the Tsurugi is tail heavy, 6 ounces of lead have to be added for balance.
- There are no ball bearings on the lower control levers.
- A starter extension is not included.

FINISHING

The canopy of the Tsurugi is made of clear Lexan. I trimmed around the back and drilled four holes that are used for the rubber-grommet mounting system. I then painted it on the inside with R/C car-body paint and back-coated it with white K&B* Superpoxy paint. I used Goop adhesive to join the two halves. This type of canopy can be painted on the inside or the outside, and it comes with a set of decals. The tail fins are hollow and are covered with an adhesive film. This film has green and red trim, and this limits your color choice on the canopy.

The 655mm laminated wooden blades have a semisymmetrical airfoil and are supplied with heat-shrink covering material. I used 3-hour epoxy to glue the lead weights in place and then I sanded and covered the blades. Be sure to remove the covering from beneath the plastic root end and secure the ends in place with CA. My finished blades came out to 179 grams.



The rear-mounted, tail-rotor servo provides tight, responsive tail-rotor control and makes disassembly of the Tsurugi very easy.

SETUP

The servo setup on the Tsurugi is very simple. I set my transmitter sticks to mid position and adjusted all the rods from the servos to the swashplate, making sure that all the servos, the bellcranks and the swashplate were perpendicular and level. I then adjusted the blade grips to give me 0 degrees of pitch. This gave me a pitch range of +10 to -9 degrees. I activated the points on my pitch curves to set up normal, idle-up, vee-curve and hold pitch settings.

My Tsurugi was tail heavy, leaving me no choice but to add weight. It took 6 ounces of stick-on lead to bring the helicopter's CG forward to the main shaft.

CONCLUSION

The Tsurugi is a reasonably priced, 60-size machine that has many advanced features that are extra on other 60-size models costing considerably more. I built this machine stock and did not have to upgrade anything. It comes with an assembled rotor head and tail transmission and, overall, the Tsurugi

(Continued on page 136)

DIE SCHWINGE

(Continued from page 33)

this design, the ideal glide angle is when the flight path is parallel with the horizon. Flight at that angle should be fast; do not attempt to fly slowly. This is *not* a floater; it needs some speed to create the lift needed for a low sink rate.

The objective is to have the proper glide angle and speed when the elevator is in neutral trim (the same setting used for the power mode). If all is to specs, this *is* possible, and no adjustments will be needed. If adjustments are needed, however, this is the procedure: glide-mode tuning is done by altering the CG, not the stab or elevator settings. This is because reasonable changes in balance will have little effect on the power mode, which has already been established. If, in the glide, there's a nose-down or diving tendency, move the CG rearward. If the glide is too slow or nose-high, move the CG forward. Note that equipment compartment sizes are such that the receiver and power batteries can be interchanged to suit balancing needs. But if all else fails, don't hesitate to use ballast!

It takes time and effort to fine-tune like this, but the reward is a much finer performance from a model that's even easier to fly! You'll appreciate the results of your efforts.

SCHWINGE ON THE WING!

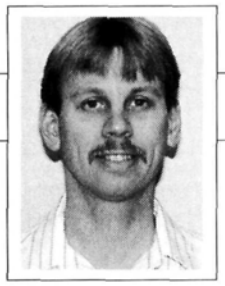
With the Schwinge being what might be called a "windy weather" flier, I've flown more in strong wind than would be the norm, and I've enjoyed some exciting flights not seen in calmer weather. When there's good lift, the Schwinge picks up noticeable speed in the lift (for whatever reason) and really tears around the sky. In the glide mode, it probably flies as fast as it would with power on in a light wind. Such performance really turns on the adrenaline!

The "gang" called another finding "wind surfing," even though we weren't ridge soaring. In a strong wind, the model is flown upwind and off to one side of the pilot's upwind view. It's then turned until it's flying at 90 degrees to the wind and to a point about as far off center as it started from. If the turnabouts are always made upwind, the Schwinge will speed across the course so quickly that there will be little downwind drift. The crosswind path should be about 800 feet or more. We found that, with this flight path repeated over and over, no altitude is lost. At times, the flight was so long it was boring; this is a different and very neat way to extend flight time!

Here are a couple of hints to make windy-weather flying tolerable:

(Continued on page 136)

CENTER ON LIFT



MICHAEL LACHOWSKI

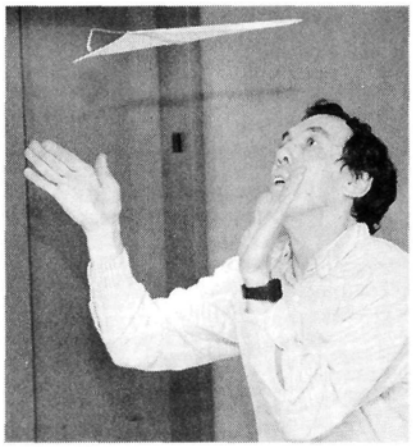
NEW ENGLAND R/C SOARING CONVENTION

NORMALLY, the Northeast isn't the best soaring location in November, but two trips to the north and south ends of the East Coast late last year provided some soaring diversions worth reporting. First up is the New England R/C Soaring Convention. This gathering was a great success. Then I'll talk about a trip to Florida and an opportunity to try out a new unlimited sailplane—the Spectrum from Spectrum Enterprises*. Finally, I have some exciting news about a new wind-tunnel testing program that will pick up where the Princeton tests left off.

NEW ENGLAND R/C SOARING CONVENTION

The DownEast Soaring Club did a terrific job of putting together the first New England R/C Soaring Convention on November 20. More than 60 soaring pilots attended the presentations, which covered diverse topics such as micro hand-launch gliders, slope soaring, F3B soaring and kit development and manufacturing. The convention took place at the Sheraton Tara Hotel in Portland, ME. Other than cold weather and short days, the location was terrific with plenty of shopping opportunities nearby. My favorite spot was Gritty McDuff's brew pub, which offered an excellent selection of beers brewed on the premises.

Terry Sweeney discusses his 4-ounce R/C hand-launch glider. The little basket on the side held a never-ending supply of interesting items that Terry has tried or is planning to use in his quest for an even lighter model.



Terry Sweeney performs his "slope head" act. As he walks across the lobby, the model slope soars off his hands and forehead. It really does work.

Some pilots arrived early on Friday and did some slope soaring before the convention. All the presentations were on Saturday, and Jim Armstrong welcomed everyone and introduced all the speakers. First up was Paul Cousins, a local meteorologist and an excellent speaker. Storm tracks through this area of the country and the effects of Mt. Washington sure make weather prediction challenging. Lenticular clouds were part of Paul's discussion, and on Sunday, the weather cooperated and provided some excellent examples of them over the mountain.

HILLS AND WIND EQUAL SLOPE SOARING

Dave Garwood provided an excellent introduction to slope soaring, including some excellent slides showing the basics. You don't have a slope? Look harder, and you'll probably find one—especially in the winter when leaves are off the trees. Dave's pictures included several inland slopes at incomplete highway overpasses and trash hills. The most spectacular site Dave showed was Mt. Greylock in western Massachusetts. The town in the background is more than 3,000 feet below. The site's only drawbacks are its poor landing areas and the hikers and sightseers that force you to fly only during the off-season.

Rick Roelke followed Dave with a presentation on hand-launch glider flying. Rick really enjoys this, and he related stories about how his hand-launch glider flying evolved from a floater up to the Lawn Dart he currently flies. Rick touched on all aspects of hand-launch glider flying: learning, designs, launching, finding lift and contests.

Stan Eames of NorthEast Sailplanes* provided a look at the kit manufacturing business and the economics of producing them. It's a really tough business to make money in if you just stick with the typical 2-meter and unlimited competition designs. Stan based his discussion of the economics on an unlimited-class design. I wish I had a copy to give to folks who occasionally ask me if I'm ever going to kit any of my designs. I'll stick with my regular job and keep R/C soaring as a hobby. Of course, NorthEast kits a variety of sailplanes in addition to marketing other designs. Stan talked about the kinds of designs NorthEast Sailplanes looks at for kitting.

At the end of the convention, NorthEast Sailplanes gave away a Sparrow kit that they recommend to anyone looking for a design to fly just for fun. Everyone put a card with the name of a sailplane that they would recommend into a balloon, and then we bounced the balloons around the room. Finally, everyone opened them to find the winner of the Sparrow kit. Too bad I don't have all the cards. It sure would be interesting to see what everyone recommended.

The symposium was a bargain—only $20—and it included a cold buffet lunch. Dennis Phelan started the afternoon sessions with, "Why everyone should try F3B." Dennis's talk included some short segments of a videotape of the '91 World Championships that illustrated the types of flying and teamwork involved in F3B flying. He also related some experiences of various thermal pilots trying the tasks and what they learned.

After his presentation on slope soaring, Dave Garwood fields some questions from

MICRO HAND-LAUNCH GLIDERS

Terry Sweeney's discussion of micro hand-launch gliders was intriguing. He had a small basket and kept pulling one small item after another out of it. His current design is down to 4 ounces. It uses two microservos, a Tekin* receiver and small Ni-Cds that are good for 40 to 50 minutes of flying. Owing to its light weight and small size, you can fly it almost anywhere. Terry has plenty of ideas to improve the control system and make the model even lighter; who knows where it will all end? Later in the afternoon, Terry flew a 1-ounce foam glider in the lobby by slope soaring it off his forehead! Check out the picture.

Tim Renaud from Airtronics* gave the last presentation. Tim talked about the history of computer radios and how soaring fits into Airtronics' business. Tim recommended the Infinity 600 over the 660 for a soaring pilot, and he says that another batch of Vision radios will be produced this year. The Vision is still the best choice for a soaring pilot. Airtronics is phasing out all the wooden kits and will be producing only the newer foam-wing kits. The wooden kits were impeccable in quality and will be sorely missed.

A great raffle ended the symposium. Top prizes included an Infinity 600, a Futaba* 7UGFS, a NorthEast Sailplanes Monarch hand-launch glider, an Airtronics Thermal Eagle and a vacuum-bagging system.

Some attendees brought in some models for discussion after the talks, and everyone planned where to fly on Sunday. Some pilots went to a nearby high school for hand-launch gliding and electric flying, while other groups ventured out to some of the nearby slope sites. I put in some flying on Bailey Island; other fliers ended up at Clark Cove on Harpswell Sound. New England slope sites are very picturesque, but landings are tight, and a few pilots damaged their planes on landings because of cold thumbs.

The Soaring Convention was a great success: it was interesting, the speakers were well-prepared and the flying was enjoyable. I encourage DownEast to make it a regular event, and you should add it to your schedule of soaring events.

AIRFOIL TESTING, PART 2

Take a quick inventory of your fleet, and count how many models have airfoils such as the S3021, SD7037,or SD8020.

THE SPECTRUM

Kit manufacturers continue to improve construction techniques to provide us with models of ever higher quality. The latest entry in the unlimited market is the Spectrum from Spectrum Enterprises. By now, you may have read that this design finished first and third in Visalia in the able hands of Daryl Perkins and Mark Triebes. I borrowed one of the prototypes and flew it to third place during a visit Down South to the Tangerine.

Rudolf Freudenthaler and Ed Siegers each hold a Spectrum.

The overall design looks really good, and the details make it more impressive. The fuselage is made of fiberglass, with Kevlar tow reinforcements for strength. It's large enough to comfortably take a radio. The nose cone comes with a molded skid you can carve into whatever kind of sharks' teeth you desire. The model stops instantly on landing at my local sod farm. A T-tail with an elevator and enclosed control horns on a nicely faired fin completes the fuselage and tail. This makes for a rugged model, and the elevator provides excellent response (without the dead spots that are sometimes found in flying stabs).

The Spectrum has a two-piece plug-in wing that comes sheeted with cut control surfaces and routed servo holes. The balsa in the wing along the control surfaces is really nice; you don't have to cap the edges of the wing control surfaces. This means less work for you and fewer chances to warp the control surfaces. It has the common triple-taper wing with a straight trailing edge, and the swift tip shape gives it a distinctive look. (Just watch out for hanger rash on the tips.)

I flew the RG15 version, which weighed in at 68 ounces. The Spectrum can be as light as 58 ounces, and it's supposed to weigh 60 ounces and have a 10-ounce wing loading. After one day of setting up the control surfaces, I picked up first place at a local club contest. I had no problem thermalling the Spectrum in light lift.

The next time I flew the Spectrum was during a Thanksgiving weekend trip to the Tangerine in Orlando, FL. The Orlando Buzzards require the fuselage to be flat on the ground to count landing points, and I had to be very careful with the small radius of the Spectrum's nose. My only other complaint was the size of the model. Its span is only 104 inches, which makes for great handling on landings, but on the other hand, it can be a real handicap flying 9-minute maxes on a windy day when the nearest thermal just blew by the field.

The speed range of the RG15 is excellent and better than that of most sailplanes. After I had finally dialed in the proper elevator mix, I hit the max landings repeatedly. You can never be sure that you have the right mix until you put in a few landings through thermals and down air under time pressure. If the RG15 is too much for you, the S3021 is the other airfoil choice. Neither airfoil is new, but both have proved to be excellent choices for thermal designs. If you're looking for something new, check out the Spectrum.

These designs were wind-tunnel tested in 1987 at Princeton by Michael Selig, John Donovan and the late David Fraser with the support of modelers. We have all benefitted from the enhanced sailplane performance these airfoils provide.

Even though we have these airfoils, other areas of soaring and modeling could benefit from improved airfoils, and there are many other topics that need more investigation, including flap effectiveness, turbulators, contour accuracy and blending one airfoil into another from root to tip.

Michael Selig and his students are starting another modeler-supported airfoil test program at the University of Illinois at Urbana—Champaign (UIUC). This program can continue as long as funds are available for equipment maintenance/upgrades and support for graduate students. You can support the effort by assisting in building airfoil wind-tunnel models for tests, or, more important, by providing contributions. A little support from a lot of modelers could easily fund this program and allow it to go on indefinitely. Your contributions should be mailed to Prof. Michael Selig, Dept. of Aeronautical and Astronautical Eng., University of Illinois at Urbana—Champaign, 306 Talbot Laboratory, 104 S. Wright St., Urbana, IL 61801-2935. Please make checks payable to "University of Illinois, AAE Dept." Write "Selig—Wind Tunnel Testing/ AAE Unrestricted Funds" on the check, and provide a letter stating that your contribution is to be used by Prof. Selig and his group of students in support of the airfoil wind-tunnel tests. If you're interested in building test models, or if you want more details on the testing program, you should contact James J. Guglielmo at the same address.

**Here are the addresses of the companies mentioned in this article:*

Spectrum Enterprises, *distributed by Slegers Intl., Rte. 15, Wharton, NJ 07885.*

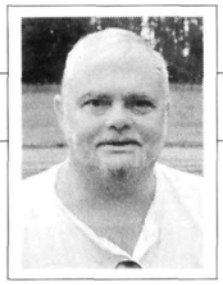
NorthEast Sailplanes, *16 Kirby Ln., Williston, VT 05495.*

Tekin Electronics, *940 Calle Negocio, #140, San Clemente, CA 92673.*

Airtronics Inc., *11 Autry, Irvine, CA 92718.*

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.* ■

SPORTY SCALE TECHNIQUES



FRANK TIANO

COLORS, MARKINGS AND MORE

THIS MONTH, my column will be devoted to showing you some neat stuff that you've probably always wished you had, that somebody you know has and that makes you jealous, that you didn't know about at all, or that is simply downright interesting. In other words, I'm going to showcase some products for you. In the next couple of months, I'll have an entire column on what you readers are building and flying, so if any of you want to see your mug on these pages, send me some photos, pronto!

FEDERAL STANDARD COLORS

Of all the scale-related items mentioned in past issues of *Model Airplane News*, none has received more reader response than the subject of color documentation and color-chip sources. As you loyal readers will remember, David Klaus* publishes a cross-reference guide of every color ever used on any military aircraft that has ever seen service. For example, if you look in the "blue" section of his book, you might see 23 blues, each identified by a U.S. Federal Standard (FS) number and followed by the type of aircraft this color was used on. The FS numbers even include cross-references for the colors used by the Axis powers during World War Twice.

So, if your documentation source says that your German airplane was painted with the equivalent of FS no. 3456, simply look in David's book, find the listing, and then get the actual color chip from the government-issued FS ones that David also sells. Pretty easy, huh?

Anyhow, the reason for mentioning the "Cross-Reference Guide" again is that it has now been updated to include color information about the aircraft used in Operation Desert Storm. If you've already purchased the book but would like the update, just send David $2 and a legal-size SASE. If you've procrastinated and wish to buy the whole ball of wax, send him $31.95; you'll receive the newest guide, along with a current FS 595 color-chip fan deck. And please mention that you saw the info here in "Sporty Scale." (Maybe I can get a freebie!)

Nick Ziroli and the very new Ole Tiger—a 42-percent Formula One racer for 4.6ci engines. The full-scale airplane spans a mere 14 feet! Madera '94 will have a Formula 1 class!

The extraordinary Fireplug will fire any glow plug (except a dead one) any time, regardless of fuel buildup. Variable voltage allows 1.2 to 2 volts. Mention that you're an AMA member when you place your order: you'll get a 10-percent discount.

This Spitfire is just one example of Bell Model Aircraft's fine line of scale rubber-powered models. The plans can easily be enlarged to .40- or .60-size sport R/C scale.

HAPPY GLOW PLUGS

I've been using a couple of electronic products for over a year now, and I'm so pleased with their performance that I'd like to share information about them. As you know, on-board glow drivers have become almost commonplace on competition models and are very popular on many sport ships as well. And if you thumb through the pages of any model airplane magazine, I'm certain that you'll see hundreds of—well, maybe a dozen—companies that offer some cute way to keep your glow plug lit when your engine needs it most. I'm sure that all the available units work, but I'm having such great success with the one manufactured by McDaniel R/C Inc.* that I now own four of them! The reason I like the Micky D unit so much is that it's entirely electronic. Just plug the thing in your throttle channel, and it's infinitely adjustable, just by turning a little screw. A remote LED shows you when the plug is getting juice, so there's absolutely no guesswork involved.

The other product that I really enjoy is the Fireplug glow battery produced by Twinn-K*. This battery is the roughest, toughest, biggest and baddest starting battery you will ever come across. I can

almost guarantee that! It's rechargeable, of course, and it has a variable voltage switch that can be boosted to 2 volts to clean out the most stubborn, fuel-soaked or fouled plug imaginable. For usual sport flying, I would say that a charge will easily last over two months. This is the unit that most pylon racers would never be caught without.

The Fireplug, with its special charger, retails for about 60 bucks, but the duo is well worth the money. The part number for the combo is 42372; Twinn-K says it's OK to call and order one for yourself. The phone number is (216) 433-1988; ask for Bill or Bob.

RUBBER SCALE

Many of you may have read about the Mass Launch event held at last year's Top Gun. Any contestant, pit-crew member, judge, or Palm Beach Aero Club working member was allowed to take a shot at a gorgeous trophy and some considerable bragging rights! For '94, the rules have been changed to allow any size of rubber-powered scale models to compete. And that's the only rule! If you haven't seen the likes of Dave Platt, Nick Ziroli, Bill Steffes, Jeff Foley, Bob Violett, Terry Nitsch, Bob Underwood, or others all launching these rubber-powered scale models at the same time, you've missed a real treat! Obviously, the last one down wins.

This brings me to still another announcement. John Bell operates a company called Bell Model Aircraft* in Largo, FL. His specialty? Accurate, rubber-powered, scale models that really fly! Some kits, some plans and all nice; in fact, some guys blow up the plans to make really cool .40-powered sport models. Bell offers drawings, too. And I'm talking about really good drawings for some popular and unusual aircraft as well. A sample of his Douglas B-23 and P-40F came my way, and I gotta tell ya, they're great drawings. Most are five-view and are on large paper. I truly think that the $3 catalogue is a worthwhile investment for any scale modeler.

Mrs. Sporty Scale (Carol Tiano) holds the flyer for David Klaus's newest IPMS color-chip guide. The latest version includes the new government 595 FS color chips—all 1,200 of them!

OUTSTANDING MARKINGS

Some time ago, I mentioned several companies that produce rub-off markings from your supplied artwork. These types of high-quality markings allow some interesting scale color schemes to be completed by those of us who have little or no artistic ability. (In other words, we have trouble duplicating even the most basic markings in paint!)

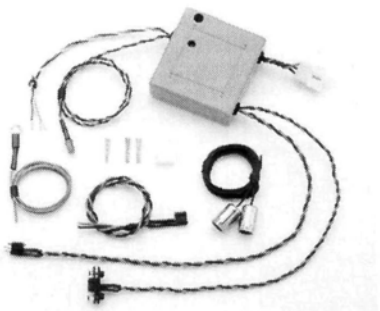
Well, one of these companies has perfected rub-off markings that are easy to apply, cost less and are hot-fuelproof to boot! (They don't have to be clear-coated.) The company is Mike Anderson's Dry-Set*, and we tried his services firsthand by putting in an order for some custom markings for a Byron P-51 that we were building for a customer. The results were outstanding! The markings can be applied quickly and easily.

A few words of caution: you get one shot at putting a marking on your airplane. If you make a mistake and put it in the wrong place, there's no way to reuse it; you'll need another marking. My suggestion to people who order markings from Dry-Set is that they spend a couple of extra bucks for the cheapest "practice sheet" that Mike offers so that they can get the technique down perfectly. No, it's not hard to do, but for those who have no experience with rub-off markings, I think that my advice is good.

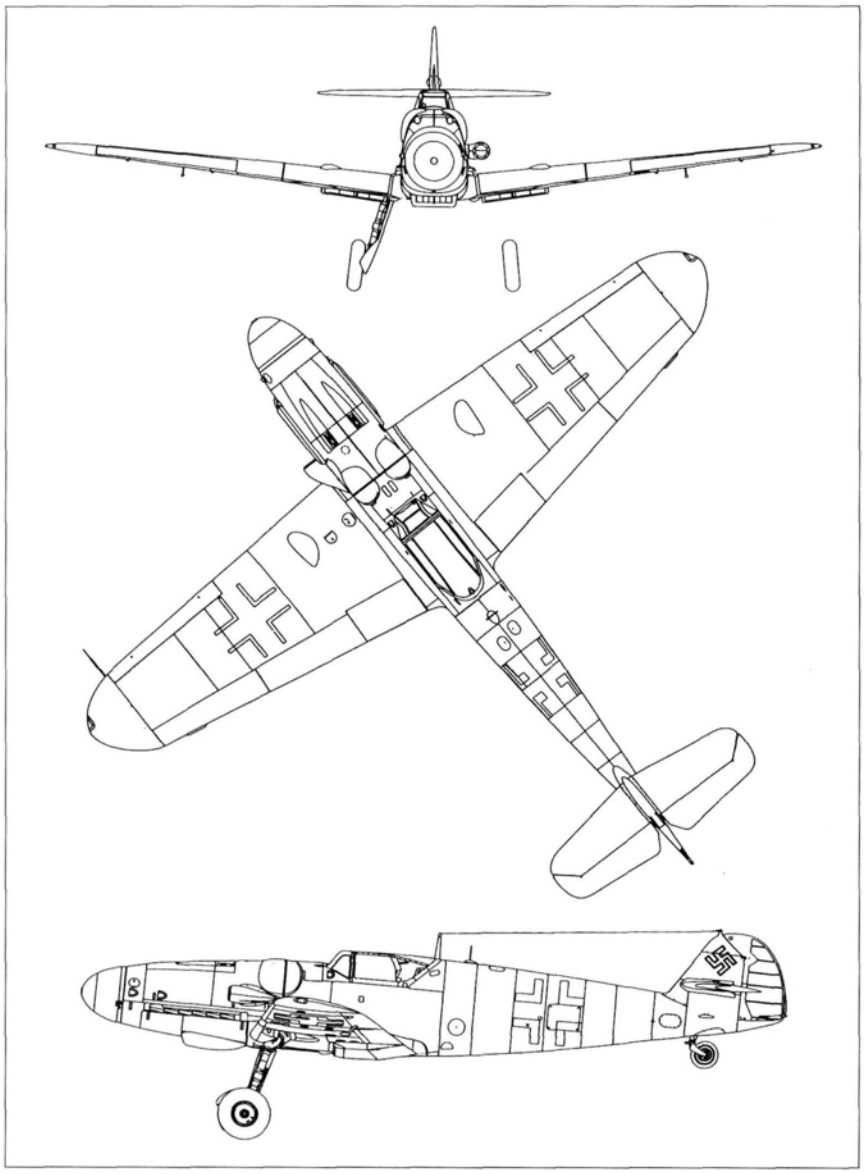
Pat McCully gets a grip on a Byron Mustang. All the markings were produced by Dry Set; they will produce special markings in any scale you wish. The markings are faster and much neater to use than paint.

OLE QUICK NICK

Well, Quick Nick is at it again! I'm referring, of course, to Nick Ziroli*—the senior variety—and his announcement of yet another new aircraft plan design. It's for the new 42-percent Formula One racing class planned for the Madera Air Races. Nick's rendition of "Ole Tiger" spans 72 inches and packs 1,510 square inches of wing area. Plans sell for $38, and a canopy, wheel pants, landing-gear legs, wing-mounting tubes and hardware are also available. By the way, this new class is gonna be pretty hot and cool at the same time. The rules call for any design at 42-percent scale, and any engine—full-race permitted—of up to 4.6 cubes. Nick says it should make for some spirited and exciting racing! I have to agree.



A McDaniel R/C onboard system is shown here for a twin-cylinder engine. Single-cylinder units are similar, but they use only one glow-plug lead. It comes complete, and McDaniel can even supply a special drive battery.



Messerschmitt Me-109G with Erla Haube canopy.

MESSERSCHMITT THREE-VIEW

Last, but certainly not least, this month, I am offering a three-view drawing for all you guys who have written requests for drawings of the ME-109G with the Erla Haube canopy with the field modifications of the shorter tail wheel and with the DF loop antenna removed. A bit of trivia? The updated, blown canopy used on G-6s is often erroneously called a "Galland hood." The Galland hood is actually the clear piece of cockpit armor behind the pilot. Now that this three-view has been published, it can be used legally for documentation purposes. You're quite welcome! If any of you are looking for a three-view that you just can't find, let me know. Maybe we can scare up something for you, too.

Well, so long for now. Enjoy your building season and, if you've got a few minutes, why not drop one of the editors or me a line and tell us what else you'd like to see here in "Sporty Scale." Of course, any of you with scale-contest or fly-in coverage photos are welcome to forward them to me for

(Continued on page 137)

CLUB OF THE MONTH

WESTMINSTER AERO MODELERS

c/o Milt Peacock, 2313 Da Lib Rd., Finksburg, MD 21048

This month's honor goes to the Westminster Aero Modelers for their informative and entertaining newsletter, "The Tailspinner." In the December issue, they mention everything from payment of dues to a School Flight Program (SFP). This six-year-old, club-sponsored program is helping to promote the sport to youngsters, and so far, it has touched the hearts of more than 13,000 kids nationwide. Club member Ray Miles says that the program's success is partly due to generous contributions from companies such as Lanier RC. When he saw an ad by Lanier illustrating "The World's Largest Rubber Band," he wrote to Lanier's Bubba Spivey and told him about six schools in which he and the kids aren't allowed to fly R/C airplanes. Ray writes, "A few weeks ago, that 'kit' arrived via UPS.... It's a 6-foot-span Styrofoam ARF. The rubber is enclosed in a ¾-inch metal tube with the prop and spinner as one unit." Ray also credits the program's success to the diplomatic efforts of club newsletter editor Milt Peacock.

The pages of this newsletter are filled with humorous quips and quotes. There's a word puzzle, a David Letterman-style "10 Reasons to Fly Safely," a "For Sale" section, helpful modeling tips and a "Safety" section in which flutter is discussed. There's even a portion of a travel log from club member John Schaffner's European trip. He writes about his unforgettable experiences during his trip to London and other parts of England.

Congratulations to the Westminster Aero Modelers club for its soup-to-nuts newsletter! We wish them continued success with their SFP, and we hope that they enjoy their two subscriptions to *Model Airplane News*. It's an award that's well-deserved. ■

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the ***Model Airplane News*** **Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address and telephone number.

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NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

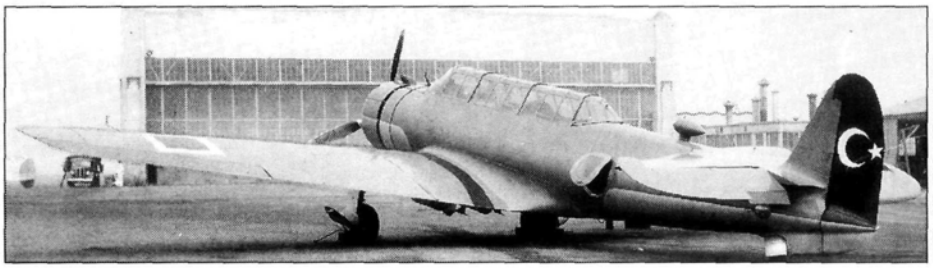


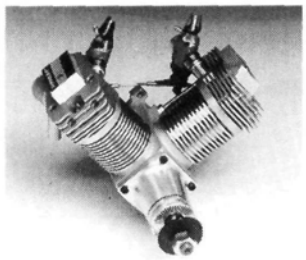
PHOTO COURTESY OF RAGWING AEROPLANE CO

CONGRATULATIONS to Charles Gewalt of Napa, CA, for correctly identifying the January '94 mystery plane. The Ultra-Piet ultralight was designed by Roger Mann of the RagWing Aeroplane Co. in Liberty, SC. The plane is a single-seat, ¾-scale version of the popular Pietenpol Air Camper monoplane, which first flew in 1929. Like the original Pietenpol, the all-wood Ultra-Piet is a plans-built, "home-built" aircraft. Household-grade lumber is used in its construction, and the under-cambered wing ribs are built in a traditional truss configuration with ¼-inch-square spruce capstripping and plywood gussets.

The Ultra-Piet debuted at the 1993 Ultralight Fly-In in Lakeland, FL, and it was an instant success. Powered by a Kawasaki 440A 2-stroke engine, it weighs 278 pounds (including its ballistic safety chute) so it's legal as an ultralight under the FAA's regulations (FAR part 103). Its pilot doesn't need a license. The Ultra-Piet is 15 feet long and has a wingspan of 25 feet, 6 inches. It's covered with Dacron and painted with latex paint to save weight and building costs. Its takeoff roll is about 100 feet, and it can land in as little as as 150 feet. The Ultra-Piet's maximum cruise speed is 55mph; its stall speed is a leisurely 24mph. ■

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

PRODUCT NEWS



PROCTOR ENTERPRISES
Laser 4-Stroke Engines

Proctor introduces two Laser engines—the 160V twin and the 200V twin. Both use wedge-shaped combustion chambers that have valves angled toward the rear to ensure maximum power without the detonation that's often associated with 4-strokes. All Laser engines feature twin piston rings, plated cylinder liners, twin camshafts and replaceable valve guides. The cylinder head and the crankcase are machined of solid aluminum for durability.

Prices—$675.50 (160V); $695.50 (200V).

Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002; (603) 678-1300.

HITEC RCD
HS-705MG 1/4-Scale Servo

This ¼-scale servo has three metal gears, and it can be used for tough applications. It comes with a top ball bearing and a metal ring to protect the horn from stripping. At 4.8V, the torque is 160oz.-in. at .27 sec./60 degrees, so you can achieve 200oz.-in. of torque using a 5-cell Ni-Cd battery pack. The 705MG has an SMT circuit with four powerful FETs to withstand the torque that's generated.

Part no.—HSE0705; **price**—$69.95.

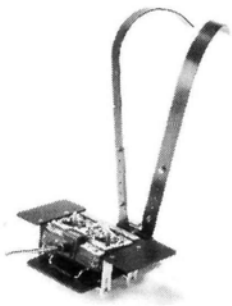
Hitec RCD Inc., 10729 Wheatlands Ave., Ste. C, Santee, CA 92071; (619) 258-4940.

GREAT PLANES
Piper J-3 Cub

Nearly all of the wooden parts of this easy-to-build kit are balsa. The wing has a shaped balsa leading edge, and that makes assembly faster and easier than that of other Cub models that use hardwood dowels. It contains many scale detail parts, such as wing struts, landing-gear fairings and both right and left "dummy" engines. Full-size plans and decals for accurate markings are also included. Specifications: wingspan—76.5 inches (standard), 61.5 inches (clipped wing); wing area—820 square inches (standard), 653 square inches (clipped wing); weight—6.5 to 7.5 pounds; length—49 inches. It requires a 4-channel radio and a 2-stroke .40 to .60ci engine or a 4-stroke .48 to .80ci engine.

Part no.—GPMA0160; **price**—$124.99.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

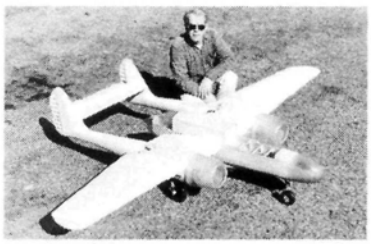


DU-BRO PRODUCTS
Transmitter Tray

This ergonomically designed transmitter tray has fully adjustable aluminum shoulder straps and a palm rest. The tray's fingertip handling allows precise control of a model. Constructed of polished, anodized-aluminum bar stock and UV-stabilized plastic, this tray will hold any transmitter securely.

Part no. 620; **price:** $89.95.

Du-Bro Products Inc., P.O. Box 815, 480 Bonner Rd., Wauconda, IL 60084; (708) 526-2136.



THE AEROPLANE WORKS
P-61 Black Widow

This ½-scale pre-cut kit is made of the best available balsa and plywood materials, and the custom-cut parts match the Nick Ziroli construction plans. Items that are difficult to obtain, such as the aluminum tube and sleeve assemblies that are used for the plug-in wing panels, are also included. Specifications: wingspan—114 inches; recommended power—two 35cc to 52cc gas engines.

Price—$500 (plus $10 S&H in the continental U.S.).

The Aeroplane Works, 2134 Gilbride Rd., Martinsville, NJ 08836; (908) 356-8557.

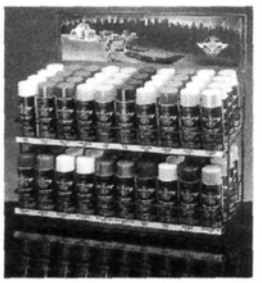
M.M. NEWMAN CORP.
Miniature Soldering Iron

The Antex Model C soldering iron features a pencil-thin handle for precise control and is suitable for a variety of soldering and cutting tasks. For optimum thermal efficiency, the iron's heating element is directly under the tip. The iron comes with a standard tip, and special slide-on tips, including a conventional spade, a chisel, a stubby, a needle, a pyramid, a cone and a hot knife, are also available. The tips are made of a special copper alloy that allows them to heat up and recover rapidly, and they're nickel plated for easy wetting. The iron heats up to 700 degrees Fahrenheit and is ready to solder in 45 seconds.

Prices—$19.95; $1.55 (replacement tip).

M.M. Newman Corp., 24 Tioga Way, P.O. Box 615, Marblehead, MA 01945; (617) 631-7100; fax (617) 631-8887.

PRODUCT NEWS



COVERITE

21st Century Paint

Create an array of military paint schemes with Coverite's 21st Century's five new colors—Military Flat Gray (no. 8120), Military Flat Earth (no. 8121), Military Flat Blue (no. 8122), Mid Blue (no. 8123) and Stintson Green (no. 8124). The paint dries dust-free in 15 minutes, can be re-applied every three minutes and is fuelproof (up to 15-percent nitro) in 12 hours.

Price—$6.95/can.

Coverite, 420 Babylon Rd., Horsham, PA 19044; (215) 672-6720.

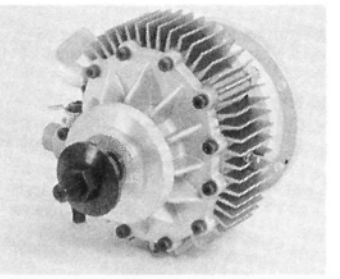
APPIAN PRODUCTIONS

Acc-U-Vac 227

Use this vacuum-forming machine to make canopies, engine cowls, drop tanks, wingtips and much more. Its heavy-duty, built-in, powerful, second-stage vacuum pump will pull 27 in. Hg. for that critical surface detail. Everything required to start Acc-U-Vac forming is included: detailed step-by-step instructions, plastic molding sheets, a frame, an oven tray and all the necessary accessories. The unit can form molds up to 4 inches high using standard 11x14-inch plastic sheets.

Price—$169.95 (plus $9.50 S&H in the continental U.S.).

Appian Productions Inc., 145 W. 58th St., New York, NY 10019; (212) 265-8598.



HOBBY LOBBY

Wankel Engine

The Graupner NSU/Wankel is an air-cooled, single rotary piston, 4-stroke glow engine for large model aircraft. Although it's very powerful, it has minimum vibration, even at high rpm. Its size and shape make installation easy. A mounted pull-starter (not shown) is also included. Specifications: 2.25ci; rpm range—2,500 to 11,000; maximum power—4.5b.hp at 10,000rpm; maximum motor diameter—4⅞ inches; length—(including shaft) 4¼ inches; weight—64 ounces; recommended props—20x8 or 18x10.

Price—$1,590.

Hobby Lobby, 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.

HOBBYTECH INC.

Pocket Wind-Speed Indicator

This highly accurate indicator measures wind speeds of up to 60mph at ground level. It features a sleek, state-of-the-art design, and it's light, compact, durable and easy to use. You can carry it in your pocket or field box. A conversion chart that's on the top of the unit gives the speed in miles per hour.

Price—$69.95 (plus $3.25 S&H).

Hobbytech Inc., 34 Joslyn Dr., Elgin, IL 60120; (708) 695-5903; fax (708) 837-6235.

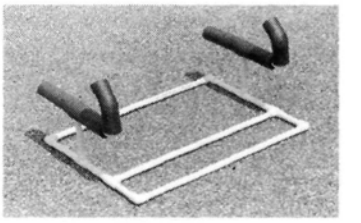
J'TEC

Exhaust Systems

J'tec offers two exhaust systems for the Madera Rule AT-6 racing events. The specially designed aluminum exhaust adapter, adjustable elbow and flexible metal exhaust tubing place the engine exhaust in the exact scale location. Systems for 45-degree engine mounting and inverted engine mounting positions are complete and ready to install.

Part nos.—AT645 (45-degree mounting), AT6IN (inverted); **prices**—$29.95, $37.95.

J'tec, 164 School St., Daly City, CA 94014; (415) 756-3400.



AIR FLAIR

Smith Super Special Stand

Designed by National Fun Fly champion Jerry L. Smith, this stand is perfect for holding and protecting your aircraft. Plans for the stand are now included in the Stickit V, Stik-Munk and Diamond Tea kits. For a free copy of the plans, send an SASE to Air Flair, 1750 Lundgren Rd., New Carlisle, OH 45344; (513) 849-0411.

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

Manufacturers! To have your products featured here, address the press releases to **Model Airplane News,** attention: Julie Soriano.

CLASSIFIEDS

RATES: non-commercial—25 cents per word. No charge for name and address (no commercial ads of any kind accepted at this rate); commercial— 50 cents per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. **All ads must be paid for in advance.**

To run your ad for more than one month, multiply your payment by the number of months you want it to run. Deadline: the 10th day of the month, 3 months in advance e.g., *January 10 for the April issue.* We don't furnish box numbers, and it isn't our policy to send tear sheets. **SEND AD AND PAYMENT TO: CLASSIFIED ADS, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.**

R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

WANTED: model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [6/94]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

WANTED: model-airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/94]

MISSILE SECRETS—engines, rockets, U-build. $2. Northtech-A5, 813 Cherry Ave., Albany, GA 31710

WANTED: *old engine parts, misc. junk before* 1970. Wesley Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003. [7/94]

CLEVELAND KITS (AND PLANS) WANTED: Immediate cash, call or ship for offer. Ship to Jay Herbert, P.O. Box 1286, Mattituck, NY 11952; (516) 298-4135; fax (516) 298-4181. [3/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE:100 pages–timers, needle valves, orginal cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 post-paid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [8/94]

NEW ZEALAND AERO PRODUCTS—Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Fiberglass parts; hardware packs; timber packs; color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03) 212-8192. [2/95]

SCALE DOCUMENTATION-MODEL PLANS—Drawings, photo packs, monographs, unusual aircraft. Illustrated catalogue: $2 (post-paid). Bill Young, 8106 Teesdale, N. Hollywood, CA 91605. [4/94]

HELICOPTER SCHOOL—five days of hands-on instruction with X-Cell helicopters and Futuba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 300 satisfied students and 10,000 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (800) 452-1677. Outside USA: (904) 698-4275, or fax (904) 698-4724. [6/94]

ANTIQUE AIRPLANE PRINTS, 8x10 color prints. Stearman, Gee Bee, Waco, Jenny, P.T. Ryan; 10 in all. Send $1 (refundable) for color brochure. Robert Kohr, P.O. Box 204, York, PA 17405. [5/94]

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). Specify needs. Send SASE and 60 cents for list. Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

PAYING $50 each for toy metal outboard boat motors. Oliver, Evinrude, Johnson, Gale, Wen-Mac, Sea Fury, etc. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684; (616) 941-2111. [5/94]

CUSTOM KIT BUILDING. Will build most kits from trainers to quarter scale; 20 years experience. Write for quotes: Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [5/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [11/94]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; *free information. Concept, P.O. Box 669E, Poway, CA* 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [5/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [11/94]

WANTED—CONTROL-LINE profile kits: Midwest P-63, Skyraider, P-51, ME-109, Sterling Navion, Starfire, Skyshark, P-40, Sportster. Throttles: Rotovalve, Dynamic 19/60, McCoy 19/35 RD/BL, K&B 19/35 grn. Engines: McCoy 19/35 R/C RD/BL, three-line bellcranks. Paul Patterer, 114 Mosher Ave., Battle Creek, MI 49017; (616) 965-5364. [3/94]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [5/94]

ARE YOU TIRED OF PAYING $1.29 for six screws? For a *free* catalogue and price list of screws, nuts, locknuts, blind nuts and more, in sizes from 0-80 to ¼ inch, contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (800) 892-6917; fax (908) 788-2607. [5/94]

MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [3/94]

FOR SALE: Ignition engines, all pre-1950. Send large SASE: Leonard Roberts, 3819 Lydon Lane, Moosic, PA 18507; (717) 961-2357. [3/94]

FOUR 1993 SCALE CATALOGUES—SPPS super-scale plans, SPPS *scale handbook, ASP aircraft drawings handbook (three-views).* Catalogues—$5 each. Overseas airmail—add $5, 1 to 4 catalogues; 140 *different scale plans; 120,000 photos. Visa/MC. Jim Pepino's Scale Plans* and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. [4/94]

WANTED TO BUY: *original kit form, circa* 1968 to 1970, "Schoolgirl" by Top Flight. Barbara Blythe, 2227 N. Fremont St., Monterey, CA 93940; (408) 372-7586. [4/94]

NEW TO RC?—booklet: "Selecting, Building, Flying Your *First* Radio Model"—$4, including postage. Dr. Little, #1 E. University Pkwy., #209, Baltimore, MD 21218. [5/94]

WANTED: Sterling discontinued Ansaldo SVA5 kit no. A-18; Spad XIII kit no. A-21; Guillow's discontinued Pfaltz D-3 kit. Collector will pay top prices. George Santikian, 7285 N. Channing, Fresno, CA 93711; (209) 439-3363. [5/94]

PLANS WANTED: originals from '30s, '40s, '50s and '60s; model airplane kits; CL, FF and rubber-powered. Jim Wesch, RR 3, Box 76, Centerville, IA 52544. [4/94]

R/C SKYDIVING—*illustrated* catalogue: $1. R/C Skydivers, Box 662N, St. Croix Falls, WI 54024. [7/94]

FOR SALE: fiberglass B-17, B-25, B-26—molds and parts. Everything *must go!* Asking $3,500. Call Don at (407) 676-4123. [5/94]

VANISH FROM POLICE RADAR! Legal jammers defeat radar and laser speed guns. Brochure— (800) 451-4477. [4/94]

GRAPHITE FILAMENT FIBER: increase strength and reduce weight. Graphite or graphite-Kevlar hybrid—1-pound, 5,000-foot spool: $24 (ppd). Send SASE for sample. Coyote, Box 1006, Huntsville, AL 35807. [4/94]

R/C SWAP MEET in your living room! Nationwide buy/sell/trade newsletter with fast circulation. Free sample copy. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521. [4/94]

SCALE DOCUMENTATION—plans enlarging. Four new 1994 catalogues. SPPS superscale plans; SPPS 130,000 documentation photos; ARGUS Scale Plans Handbook; ARGUS Aircraft Scale Drawings Handbook (three-veiws). Catalogues—$5 each (ppd, USA & Canada; overseas airmail, add $5 each). SASE for plan enlarging info. Visa/MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; phone/fax (910) 292-5239. [4/94]

PROMOTION—free biplane sport-scale plans. Send address: Sibille Concept, 272 Royal, Gatineau, Quebec, Canada J8T 8E5. [4/94]

MODEL HOT-AIR BALLOONS. Fly thousands of feet high; visible for miles at night; build for pennies each. Photo-illustrated instructions. Send $5 to Air-Crafts, Dept. B, 62 S. Gate Dr., Poughkeepsie, NY 12601. [5/94]

BALL BEARINGS—now! Full-time bearing service. Bearings in stock to fit most model engines, steel, phenolic, or polymide. Installation available. UPS service; SASE for price list: Revmor, P.O. Box 548, Palm City, FL 34990; (407) 283-6831. [5/94]

ANTIQUE IGNITION engine parts: excellent reproductions, fuel tanks, points, timers, coils, needle valves, gaskets, etc. Champion spark plugs. Catalogue—$5 (intl. airmail—$7). Aero-Electric, 1301 W. Lafayette St., Sturgis, MI 49091. [8/94]

WANTED: ignition model engines 1930s to 1950s, especially Elf, Baby Cyclone, Brown Jr., Ohlsson Custom and Gold Seal. Also model racecars, any parts, spark plugs, etc.; Woody Bartelt, 1301 W. Lafayette St., Sturgis, MI 49091; (616) 665-9693, or (800) 982-5464. [8/94]

WANTED: TOY BOAT MOTORS—outboard; metal; paying $100 each for: 35hp Oliver, 100hp Mercury. Paying $75 each for: 35 and 60hp Gales, 40 and 75hp Evinrudes, 40 and 75hp Johnsons, 40, 60, 70, 80hp Mercurys. Paying $50 each for all other Johnsons, Mercurys, Scotts, Evinrudes. Also buying gas-powered 1- and 2-cylinder Sea Furys, generic motors such as Imp, Cyclone, Tornado, etc., and 10- to 18-inch-long wooden model boats. If you have the original box, add 10 percent to these prices. Richard J. Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684-2802; (616) 941-2111. [3/94]

LOCKHEED P-38 LIGHTNING. If P-38s—R/C scale models or full size—are your *thing*, join the P-38 Model Organization International—a world-wide association for P-38 enthusiasts. For more information, send $1 to P-38 M.O.I. Medelbyvej 54 DK 2610 Rodovre, Copenhagen, Denmark.

PC PERFORMANCE: easy-to-use, menu-driven computer program predicts flight performance of R/C model aircraft. For IBM PC compatibles with monochrome or color-graphics capability. Introductory price—$15 (plus $3 S&H). Specify disk format. Softair, 10710 Evergreen Way #D305, Everett, WA 98204. [5/94]

SOFT XMITR control-stick pads. Custom look, non-slip covers—feel comfortable. For information, send SASE to Amertech, P.O. Box 9233, Wichita, KS 67277. [5/94]

SCALE DOCUMENTATION and resource guide. Larger, updated 1994 Edition. World's largest commercial aircraft collection. Over 5,000 different color FOTO-PAAKS and 25,000 three-view drawings; 152-page resource guide/catalogue—$6 (Canada—$7; foreign—$12). Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [8/94]

INTERNATIONAL AIRCRAFT RESEARCH: *need documentation? Include* name of aircraft for availability of documentation, with $3 for photo and *three-view catalogue. 1447 Helm Ct., Mississauga, Ontario, Canada L5J* 3G3. [9/94]

FOUR 1993 SCALE CATALOGUES. SPPS superscale plans, SPPS scale documentation, ASP scale plans handbook, ASP aircraft scale drawings handbook (three-views). Catalogues—$5 each. Overseas Air add $5, 1-4 catalogs. 140 different scale plans, 120,000 photos. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239, Visa, MC. [4/94]

MAKE EXTRA CASH FOR YOUR HOBBIES. Do it at home. It's easy! Send $2 with SASE to Cash Concepts, 1973 Nellis Blvd. Dept 356, Las Vegas, NV 89115. [6/94]

PAPER AIRPLANE BOOKLET. 20 unique and original paper airplanes. Great for the kids. Send $5 to: Richard Krebs, 639 West Oakland Park Blvd., Ft. Lauderdale, FL 33311. [5/94]

ENGINE TEST STAND with BHP dynamometer and thrust readout. For large and small airplanes, jet and rocket engines. Inexpensive planes $10; 2315 Mahoning Road N.E. Apt. #1, Canton, OH 44705-1913. [5/94]

ENGINES FOR SALE: new, used, early and late glows. Some with carbs *and mufflers. SASE for list: Joel Balsam, 4 Pickwick Hill Dr., Huntington* Station, New York, NY 11746-1241. [5/94]

I BUY GI JOE. I fly R/C but collect GI Joe. If you have any that you'd like to part with, call me. Thanks. Jeff Gilbert, (815) 875-4611 [4/94]

WANTED! November 1940 issue of *Model Airplane News* complete, contact: S.A. Lindberg, 115 Del Oro Circle, Colorado Springs, CO 80919. [6/94]

R/C SWAPMEET IN YOUR LIVING ROOM! Nationwide buy/sell/trade newsletter with fast circulation. Free sample copy. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521. [4/94]

FIBERGLASS WW II BOMBER MOLDS. $1,500 for everything. Ask for Don (407) 676-4123. [5/94]

SCRATCH-BUILDERS WANTED to work part time at home assisting with completion and flight test of composite kits. Need experience in one of the following: Q-500, giant-scale sport 100 inch + span, sailplane 144 inch + span. Write to Scratch-builder, P.O. Box 6165, Philadelphia, PA 19115. [5/94]

WW I PLANS—Peanut to 100 inches. Send 2 one-dollar bills for illustrated catalogue to: Clark Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [9/94]

MAGAZINE BACK ISSUES—Flying Aces, Model Airplane News, Air Trails, 1930s and '40s. FM, RCM and more. Send SASE for list to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [9/94]

P-38 LIGHTNING, COLUMBIA MODEL WORKS KIT. 95-inch wingspan, Super Tiger 2500's, Robart retracts, Futaba radio. Everything new. Never been flown. Will crate and ship. $2800; Lasalle, IL; (815) 223-6783. [4/94]

DIE SCHWINGE

(Continued from page 102)

• Instead of a normal nose-high launch, launch flat and fly out a couple of hundred feet before raising the nose with the elevator. You won't have one of those blow-back-over-your-head, neck-breaking climb-outs!

• Normally, on landing, we tend to come in nose high to keep speed down. This can be a disaster in wind. It's better to approach nose down; the wind will keep down speed, and you can flare at the last moment.

Like everything else, a couple of tricks can make a big difference and lead to much satisfaction!

I trust that I've described the Schwinge well enough to interest you in this advanced design; I hope you'll find it as exciting as I do.

**Here are the addresses of the companies mentioned in this article:*
Hobby Lobby Intl., *5614 Franklin Pike Cir., Brentwood, TN 37027.*
Airtronics Inc., *11 Autry, Irvine, CA 92718.*
AstroFlight Inc., *13311 Beach Ave., Marina Del Rey, CA 90292.*
Satellite City, *P.O. Box 836, Simi, CA 93062.*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.* ■

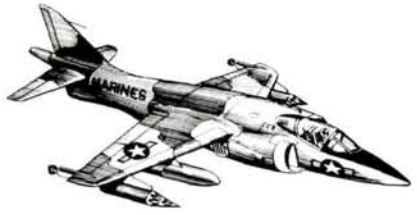
TSURUGI

(Continued from page 101)

has an extremely low parts count. It can be built in a few evenings, and it's simpler to build than most 30-size machines. Overall the Tsurugi is a pleasure to build and fly. It flight characteristics are excellent in stock form, and it will satisfy the novice as well a the most demanding pilot.

The Tsurugi would be an excellent choic for the modeler who would like to upgrad from a 30-size machine. It's also a super helicopter for the experienced flier wh desires a machine that's capable of spor hot-dog and contest flying. Its price, alon with its simplicity and flight performanc make the Tsurugi a terrific value that's har to beat.

**Here are the addresses of the companies mentioned this article:*
Hirobo; *distributed by Altech Marketing, P.O. Box 39 Edison, NJ 08818-0391.*
Enya Model Engines/Altech, *P.O. Box 391, Edison, N 08818-0391.*
O.S./Great Planes Model Distributors, *P.O. Box 902 Champaign, IL 61826.*
YS; *distributed by Futaba Corp. of America, Studebaker, Irvine, CA 92718.*
K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, 86403.*



SPORTY SCALE

(Continued from page 121)

inclusion in the column—when there's room. Until next time, let me just clarify that RPMS doesn't stand for rotating per manufacturer's specs. Your six is clear.

**Here are the addresses that are pertinent to this article:*
David Klaus, *P.O. 47110, Washington, DC 20050-7110.*
McDaniel R/C Inc., *1654 Crofton Bld., Ste. 4, Crofton, MD 21114.*
Twinn-K Inc., *4770 W. 139th St., Cleveland, OH 44135.*
Bell Model Aircraft, *650 Pine Crest Dr., Largo, FL 34640.*
Dry-Set Markings, *7029 Sanger Ave., Waco, TX 76710;*
Nick Ziroli, *29 Edgar Dr., Smithtown, NY 11787.* ■

AIRWAVES

(Continued from page 9)

EXTRA SCALE DOCUMENTATION

I'm just finishing construction of a scale model Extra 230, and I hope that you can help me in my search for scale documentation. I want to paint it to look like the full-size Extra 230 flown by acrobatic pilot Clint McHenry. You published some photos in the June '88 issue of *Model Airplane News.* Any help would be greatly appreciated.

CLAUDE DUPONT
Tolosan, France

Claude, Repla-Tech Intl. has a very nice four-view documentation drawing set that consists of two sheets drawn by Robert C. Morrison. It includes the top, left, front and bottom view of this famous plane, along with color and scale keys, scale fuselage cross-sections and wing airfoil sections. Their address is P.O. Box 461000, Cole Branch, Los Angeles, CA 90046-1000. A catalogue costs $3. GY

PIPER PICS

An article by Budd Davisson that featured a J3 Cub used by AeroSport in St. Augustine, FL, appeared in the May '85 issue of *Model Airplane News.* The Cub is flown by Jim and Ernie Moser in a demonstration where they land it on a platform that's attached to the top of a pickup truck—"The World's Smallest Airport." The article had three pictures of the Cub, but all were small and showed no top view. Do you know if any other pictures of this plane exist in the files of *Model Airplane News?* Are copies available? I thank you for any assistance you may be able to give me in locating photographs of this unique Cub.

PAT BEARD
Zachary, LA

(Continued on page 138)

AIRWAVES

(Continued from page 137)

Pat, as is the case with many articles that appear in Model Airplane News, the photos used in this article belonged to the author. After the article was run, the photos were returned to Budd Davisson and aren't available in the office. A good place to get info on Piper Cubs and perhaps actual documentation on this particular aircraft is the Cub Club and its associate club, the L-4 Wing. This organization's newsletter includes all things Cub, and they also have many back issues for a reasonable fee. If you write and ask them to include your request in their newsletter, perhaps a member will have the info you're looking for. All they would need is a copy of the article and, if available, the aircraft tail number. The network of members and the information that's available from this group of aviation enthusiasts is impressive. You can reach them at Cub Club, c/o John Bergeson, 6438 W. Millbrook Road, Remus, MI 49340-9625; (517) 561-2393.

GY

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